DOCUMENT RESUME

ED 463 177 SE 065 885

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TITLE Using Accelerated Math To Enhance Student Achievement in High School Mathematics Courses.
PUB DATE 2001-01-00
NOTE 112p.; An Action Research Project presented in partial fulfillment of the requirements of the Master of Arts Teaching Program, Friends University.
PUB TYPE Dissertations/Theses - Masters Theses (042) -- Tests/Questionnaires (160)
EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS Algebra; *Computer Managed Instruction; *Computer Uses in Education; Geometry; High Schools; Mathematics Education; Student Attitudes
IDENTIFIERS Pre Algebra

ABSTRACT

The purpose of this study is to compare the results achieved when a computer-managed learning program is used in high school mathematics classes with the results achieved when traditional teaching strategies are utilized. The control groups for Pre-algebra, Algebra 1, and Geometry received traditional classroom instruction. The intervention groups received individualized instruction as their progress through the predetermined objectives were assessed and managed using a computer software package. Following the pre-tests, 3 and a half months of treatment and post-tests, major differences were found. The intervention group showed significantly larger gains in achievement than the control group. Changes in student attitudes were also observed. Computer-managed learning systems appeared to be an effective method for teaching mathematics to high school students. Appended are: Student Surveys; Parent Surveys; Accelerated Math Teacher Survey (post); Parent Information Letter; Additional Pre- and Post-Test Statistics; and Additional Survey Results from Student, Parent, and Teacher Survey Responses. (Author/JDM)

Using Accelerated Math to Enhance Student Achievement in High School Mathematics Courses

AN ACTION RESEARCH PROJECT

Presented
In partial fulfillment
Of the requirements
Of the

MASTER OF ARTS IN TEACHING PROGRAM
AT
FRIENDS UNIVERSITY

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Abstract

The purpose of this study is to compare the results achieved when a computer managed learning program is used in high school mathematics classes with the results achieved when traditional teaching strategies are utilized. The control groups for pre-algebra, algebra 1, and geometry receive traditional classroom instruction. The intervention groups receive individualized instruction as their progress through the predetermined objectives is assessed and managed using a computer software package. Following pre-tests, three and one-half months of treatment and post-tests, major differences are found. The intervention group shows significantly larger gains in achievement than the control group. Changes in student attitudes are also observed. Computer managed learning systems appear to be an effective method for teaching mathematics to high school students.

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Using Accelerated Math to Enhance Student Achievement

In High School Mathematics Courses

The declining test scores of mathematics students across the United States have prompted national concern. There has been a renewed focus on standards and achievement at all levels. The National Council of Teachers of Mathematics has released a set of mathematics standards for grades K-12. Many states have followed that example and published state standards. At the local level, districts are examining their own curriculum objectives, aligning them with state and national outcomes.

Simply rewriting standards, however, will not improve student performance. Teachers need to look for ways to improve their classrooms and better prepare their students for the future. It is imperative to evaluate classroom instruction and assessment techniques. The focus of investigation should be on the process of teaching and learning that is necessary to facilitate change and to enable students to achieve the desired standards and outcomes.

The challenge to teachers is to find methods of instruction that are proven effective. Embracing something new just for the sake of change can be very dangerous. Teachers need to evaluate new programs carefully to determine if current research will support the claims of the particular method of instruction they are considering.

The purpose of this study is to evaluate the relationship between the use of a computer-managed learning system, Accelerated Math ™, and students' skills in selected high school mathematics courses. Students' attitudes about

mathematics are also investigated. The specific questions addressed by this study are:

1. Is there a relationship between the use of Accelerated Math ™ and students' performance in pre-algebra, algebra 1 and geometry?
2. Is there a relationship between students' attitudes toward mathematics and the use of the Accelerated Math ™ program?

Review of literature

The advent of computer technology is making it possible to dramatically change traditional educational activity. Indeed, computer technology is changing the face of education. However, research shows that simply having access to technology is not always beneficial. One report finds that technology can make a difference, but it depends on how it is used (Wenglinsky, 1998). Some uses are associated with improved student academic performance and school climate, while other uses are not (Milone, 1998; Salpeter, 1998; Wenglinsky, 1998). For example, the aforementioned report also states that the frequency of school computer use was negatively related to academic achievement (Wenglinsky, 1998). The main importance is not the quantity of computers or the amount of time students use them, but rather how they are used and the context in which they are used (Salpeter, 1998).

Computer technology is now available that provides instructional aids and computerized assessments to monitor results (Upbin, 1999). Companies have combined scanning technology with other computer hardware and software to link objectives, assessments and student records in new, efficient and

inexpensive ways (Stiggins, 1997). Computers that use a management system to track progress and give feedback are called computer-managed learning systems (CML systems) or learning information systems (LIS). Studies show computers utilizing this system have a more positive effect on student results than computers that are used strictly for drill and practice (Latham, 1999). One such study conducted with first-year economics students investigates the influence that practice tests with feedback had on unit assessment performance (Sly, 1999). All tests are administered using a CML system. The results are statistically significant ($p < .001$) for students participating in the practice and receiving formative assessment (Sly, 1999). These formative assessment capabilities in computer software programs can have a significant impact on students and teachers alike.

In an effort to determine if certain standards are being met, student achievement must be assessed. However, Black and Wiliam (1998) propose that focusing only on standards and outcomes has not been an effective way to raise standards and show achievement. This method of reform is looking at the input (objectives or standards) and the output (test results), with little or no regard for the processes of teaching and learning that occur between the two (Black & Wiliam, 1998). Formative assessments should be used to adjust teaching and contribute to student learning prior to a summative evaluation (Black & William, 1998; Sly, 1999; Stiggins 1997). If students and teachers use a formative assessment process to scrutinize practices, quality, accountability and evaluation, then standards will be used to *serve* the learning process (Cole,

Coffey & Goldman, 1999). Students are also more likely to develop the capacity to evaluate, revise, modify, and reassess their own work (Cole, Coffey & Goldman, 1999). Significant learning gains can be achieved using a variety of methods, with the common feature of enhanced formative assessment (Black and Wiliam, 1998). Computer technology can and should be used to facilitate this process.

Accelerated Math ™ is a computer-managed learning system for teaching mathematics. This program is produced by Advantage Learning Systems; a company that was founded in 1986 and provides several LIS programs. Several studies are available on the Accelerated Math program (Institute for Academic Excellence, 1999). One particular study involves inner city middle school math students with low achievement in school. These students use Accelerated Math during a mandatory summer school session. Positive results are found even in a very difficult environment with a short time-span for intervention (Spicuzza & Ysseldyke, 1999). Many of the positive results are attributed to the management system that provides detailed feedback at all levels of implementation.

When schools make a decision to implement any computer-managed learning system, it is essential to have a detailed plan (Giffin, 1991). Many studies show that teacher training is imperative (Latham, 1999; Fisher, 1999; Salpeter, 1998; Milone, 1998). These issues are also taken into account in the development of this study.

Method

This study provides an opportunity to apply current findings in research toward success in the classroom. A learning information system is used to take advantage of current technology in a cost-effective manner. Only one computer, one printer, and one scanner are needed for an entire classroom. The Accelerated Math ™ management software that is being studied provides an assessment report for every student immediately following each assignment that is scored. This provides the formative assessment that research indicates is vital to student success. Using the Accelerated Math™ program, the teacher is still responsible for instruction, and students complete their assignments at their desks using paper and pencil. Research shows this to be more effective than relying solely on the computer for the instructional process. Finally, teacher training is provided to all participating teachers prior to implementation. Numerous studies show this to be an integral part of successful program implementation.

Participants

Three different levels of high school mathematics students participate in this study. Student achievement is tested in pre-algebra, algebra 1, and geometry classes. Three teachers (one for each subject being investigated) are also involved in the study. Each teacher has at least two classes of the subject that is being observed. One class serves as the control group and continues to receive traditional classroom instruction. The other class serves as the intervention group, utilizing the Accelerated Math ™ program. Table 1 shows the breakdown of teachers and students involved in the study.

Table 1

Number of Students Involved in the Study

Class/Treatment	n		n		n
Pre-algebra (Teacher A)					
Control group	16	Intervention	19	Total	35
Algebra 1 (Teacher B)					
Control group	16	Intervention	11	Total	27
Geometry (Teacher C)					
Control group	21	Intervention	20	Total	41
Total Students Involved					
Control group	53	Intervention	50	Total	103

Materials

The materials needed for this study include the hardware and software necessary for implementing the Accelerated Math ™ program and the STAR Math Assessment. Each teacher utilizes one classroom computer, complete with a laser printer and scanner, for the Accelerated Math ™ program. The STAR Math Assessment can be conducted on an individual, classroom computer. However, this study utilizes a networked version and a computer lab. This allows an entire class to take the test at once.

In addition to the hardware and software requirements, the Stanford 9 Achievement Test is also used to measure mean gains in achievement. The Task 1 is used for the pre-algebra and algebra 1 classes and the Task 2 is used for the geometry classes.

Design and Procedure

The study utilizes a pretest/posttest design to determine mean gains for student achievement and observe any changes in attitude perception. Two tests are administered to evaluate achievement. The Stanford 9 Achievement Test and the STAR Math Test are given to all students at the beginning of second semester. This is prior to the implementation of the Accelerated Math program in the intervention groups. All students and parents are given attitude surveys during this time as well. Prior to implementation, all participating teachers receive a full-day, personalized training course on the use of the Accelerated Math software. Each teacher rearranges the Accelerated Math objectives to make sure they are in alignment with the outcomes already established for the second semester of their particular class. Therefore, the objectives that are taught to both the intervention group and the control group for each subject are identical. The treatment is similar in content, but different in the nature of instruction. Students in the control classes continue to receive instruction through the traditional method of teacher lecture followed by student assignment. Students in the intervention classes are enrolled in the appropriate Accelerated Math library, and allowed to progress at their own rate through the pre-determined objectives. These students receive most of their instruction in small groups or individually from the teacher.

The Stanford 9 Achievement Test is a norm-referenced test with a time allotment of 45 minutes, and can be taken during one class period. The pre- and post-tests are identical, consisting of 48 items. The mathematics portion of the

complete battery is used rather than the abbreviated battery because the sampling of questions is greater and broader, allowing for a more thorough evaluation of achievement. The tests are scored both by hand and by using a scanner to help insure accurate results.

The STAR Math pre- and post-tests are 24 questions in length. The computer-adaptive branching technology in the norm-referenced STAR Math test allows the students to be accurately assessed in 15 to 20 minutes. The pre-test and post-test questions vary due to the nature of the test. Scores are calculated and reported by the STAR Math software.

The pre- and post-surveys used for all students are identical. The exception is that the post-survey for the intervention groups has four additional items that relate specifically to the Accelerated Math program. The survey is brief, containing only six items. Five of the six statements contain four response levels: strongly agree, agree, disagree, and strongly disagree. Response levels are weighted according to their positive perception toward mathematics, ranging from four (most positive) for strongly agree, to one (least positive) for strongly disagree. An average response level is calculated using the weighted scores. The sixth item relates to number of hours spent on homework per week. The percentage of students who spend two hours or less on homework each week is calculated. The percentage of students responding "strongly agree" or "agree" to each of the first five statements is also calculated.

The pre-survey for the parents is identical to the post-survey. It is brief, containing only six items. Response choices are "yes", "no", "same", and "don't

know". The responses are weighted in the following manner. A response of "yes" is given a 4, a response of "no" is a 3, a response of "same" is a 2 and a response of "don't know" is given a 1. The percentage of parents in agreement with each statement is calculated using only those parents who respond with a "yes". The sixth question on the parent survey asks for the parent's perception of the amount of time their child spends on homework each week. The responses to this question are evaluated in the same manner as the responses to the homework question on the student surveys. A Copy of all surveys is included in appendix A.

Prior to the study, parents of children in the intervention groups receive an informative letter. The letter explains the changes that are taking place, summarizes the pertinent aspects of the Accelerated Math program, and invites any questions they may have. A copy of this letter can be found in Appendix B.

The treatments for the control and intervention groups are applied throughout the second semester, for approximately three and one-half months. At the end of second semester, the groups are re-evaluated, again using the Stanford 9 Achievement Test and the STAR Math Test. Mean gains are calculated for each class for each test. The attitude perception surveys are also re-distributed to students and parents. Major changes in responses from the pre-survey results to the post-survey results are analyzed. In addition to these assessments, participating teachers are also given a survey to evaluate their response to the program. A copy of the teacher survey can be found with the other surveys in Appendix A.

Results

Stanford 9 Achievement Test Data

The Stanford 9 Achievement Test scores are converted from raw scores to normal curve equivalents (NCEs). The mean gains and standard deviation are then calculated. Table 2 illustrates the results of the Stanford 9 Achievement Test.

Table 2

Descriptive Statistics for Stanford 9 Achievement NCE Scores

		Pretest		Posttest		Mean
Class/Treatment	(n)	M	SD	M	SD	Gain
Pre-Algebra						
Control	(16)	48.0	15.3	53.6	13.7	5.6
Intervention	(17)	49.0	10.2	55.7	9.4	6.7
Algebra 1						
Control	(15)	60.8	12.8	54.7	18.5	-6.1
Intervention	(11)	56.3	15.1	59.7	14.4	3.4
Geometry						
Control	(21)	61.3	14.3	70.1	18.3	8.8
Intervention	(20)	66.0	14.6	82.6	14.8	16.6
Total Group						
Control	(52)	57.0		60.6		3.5
Intervention	(48)	57.8		67.8		10.1

The statistical results for the Stanford 9 Achievement Test indicate that all intervention groups and two control groups show improvement, ranging from an average gain of 3.4 to 16.6 NCEs per class. One control group, algebra 1, shows an average decrease of 6.1 NCEs. All intervention groups from the pre-algebra, algebra 1 and geometry classes display higher average gains than the control groups for those same classes. The total control group (not broken down by class) shows an average gain of 3.5 NCEs, while the total intervention group reveals an average gain of 10.1 NCEs. The entire intervention group shows an average gain of 6.6 NCEs more than the entire control group. This information is illustrated in figure 1.

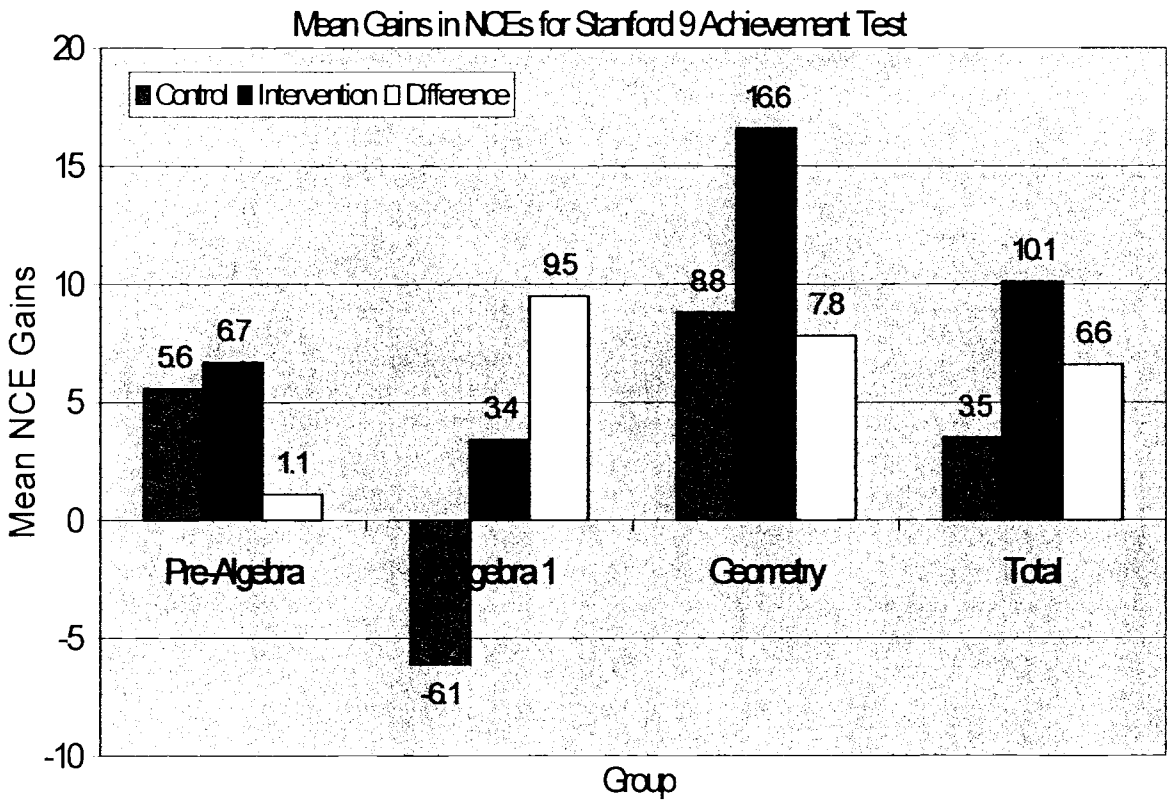

Figure 1. Mean Stanford 9 Achievement Scores in NCEs for all classes

STAR Math Assessment Data

The mean gains for the STAR Math Tests are also calculated using NCEs. The results are shown in Table 3. This display shows results similar to those found with the Stanford 9 Achievement Test.

Table 3

Descriptive Statistics for STAR Math Assessment NCE Scores

		Pretest		Posttest		Mean
Class/Treatment	(n)	M	SD	M	SD	Gain
Pre-Algebra						
Control	(16)	39.0	11.9	41.5	16.2	2.5
Intervention	(15)	36.9	12.2	43.4	12.0	6.5
Algebra 1						
Control	(16)	45.2	11.0	43.5	11.2	-1.7
Intervention	(11)	45.1	15.6	49.3	14.6	4.2
Geometry						
Control	(21)	56.4	18.7	57.8	18.1	1.4
Intervention	(20)	58.6	15.5	64.1	13.9	5.5
Total Group						
Control	(52)	47.9		48.7		0.7
Intervention	(50)	47.4		53.0		5.6

In the STAR test, all intervention groups show gains in the average NCE scores. These gains range from an average gain of 4.2 NCEs to an average

gain of 6.5 NCEs. Two control groups also show mean gains of 1.4 and 2.5 NCEs. The control group for algebra 1 has an average decrease of 1.7 NCEs. This particular control group shows an average decrease in NCEs for both norm-referenced tests.

A comparison of the mean gains from the STAR Math Assessment depicts higher gains for the intervention groups than for the control groups in every subject area. The average of 5.6 NCE gains in the total intervention group is 4.9 NCEs higher than the average gain of 0.7 NCEs for the total control group. This is illustrated in figure 2. In both the Stanford 9 Achievement Test and the STAR Math Assessment, the mean gain of the intervention group is more than double the mean gain of the control group.

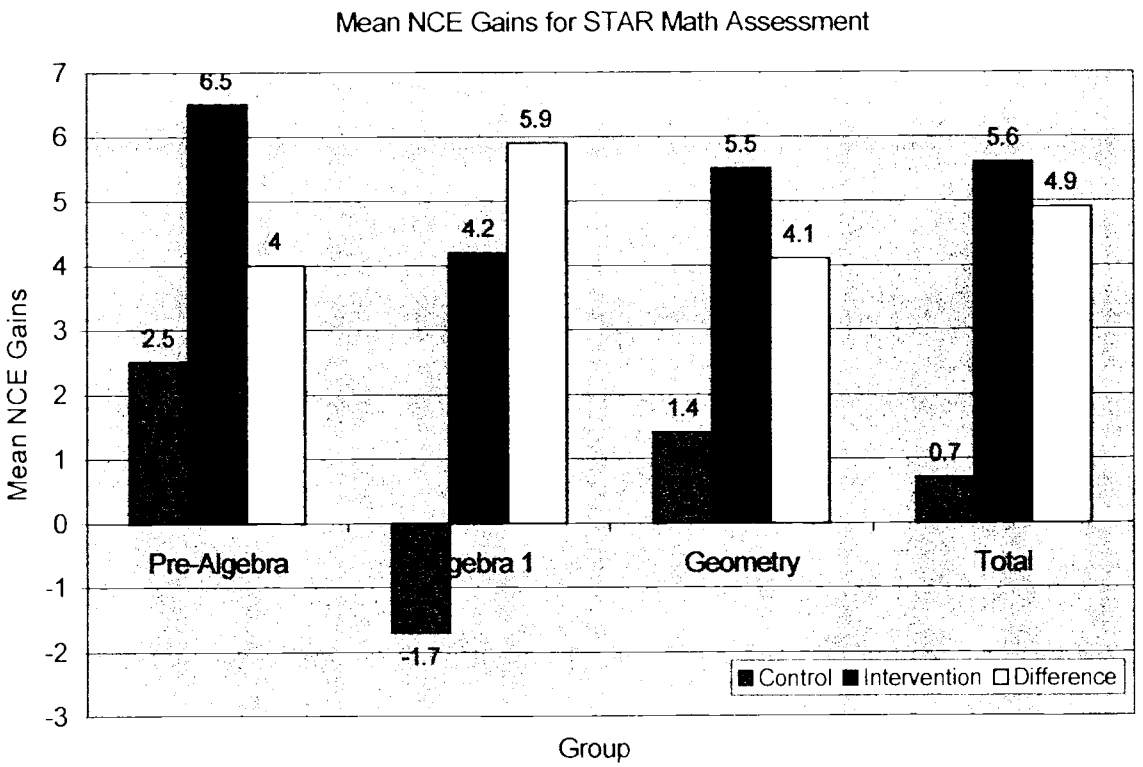

Figure 2. Mean STAR Math Assessment Scores in NCEs for all Classes.

The statistical data for the Stanford 9 Achievement Test and the STAR Math Assessment are reported here using mean gains in NCEs. Additional gains in percentile rank and grade equivalents can be found in appendix C.

Student Surveys

Student responses to survey items are converted to weighted, numerical values and averaged to find a mean score for the class. The percentage of students who select strongly agree or agree is also calculated and used to represent the number of students that agree with that particular statement. The specific items on the survey are

1. I like math.
2. I think I am good at math.
3. I learned more math this year than I did last year.
4. I spent more time on math this year than I did last year.
5. The pace of this math class is just right.
6. I average the following number of hours on math homework each week.

In order to calculate the responses the same way for all categories, the responses to statement six are grouped in the following manner. A response of less than one receives a score of 4, one to two receives a score of 3, three to four receives a score of 2 and five or more receive a score of 1.

Item responses that show a change of .5 or more in the mean or a change of 10% or more in agreement from the pre-survey to the post-survey are listed in table 4. Complete details of all pre- and post-survey averages and mean differences for each item by class can be found in appendix D.

Table 4

Number of Significant Changes from Student Pre-Surveys to Post-Surveys

Class/Treatment	Item No.	1	2	3	4	5	6	Total
Pre-algebra	Control			2	1			3
	Intervention			2			2	4
Algebra 1	Control	1				1	2	4
	Intervention	1	1	2	1	1	2	8
Geometry	Control			1			1	2
	Intervention	1		2	1	2	1	7
Total	Control			1			1	2
	Intervention			2		2	2	6
Total		3	1	12	3	6	11	(36)

It is apparent that in every class, the intervention group shows more responses with a large variance than does the control group. The two items that show the greatest number of significant changes from pre- survey to post-survey are item number 3 with twelve major changes, and item number 6 with eleven major changes. Item number 5 also experienced several changes from the pre-survey to the post-survey.

A close inspection of the third item on the survey is warranted. Figure 3 shows a graph of each class' response to the third statement on the survey, "I learned more math this year than I did last year." Students who responded "Strongly Agree" or "Agree" are included in the percentage that represents agreement.

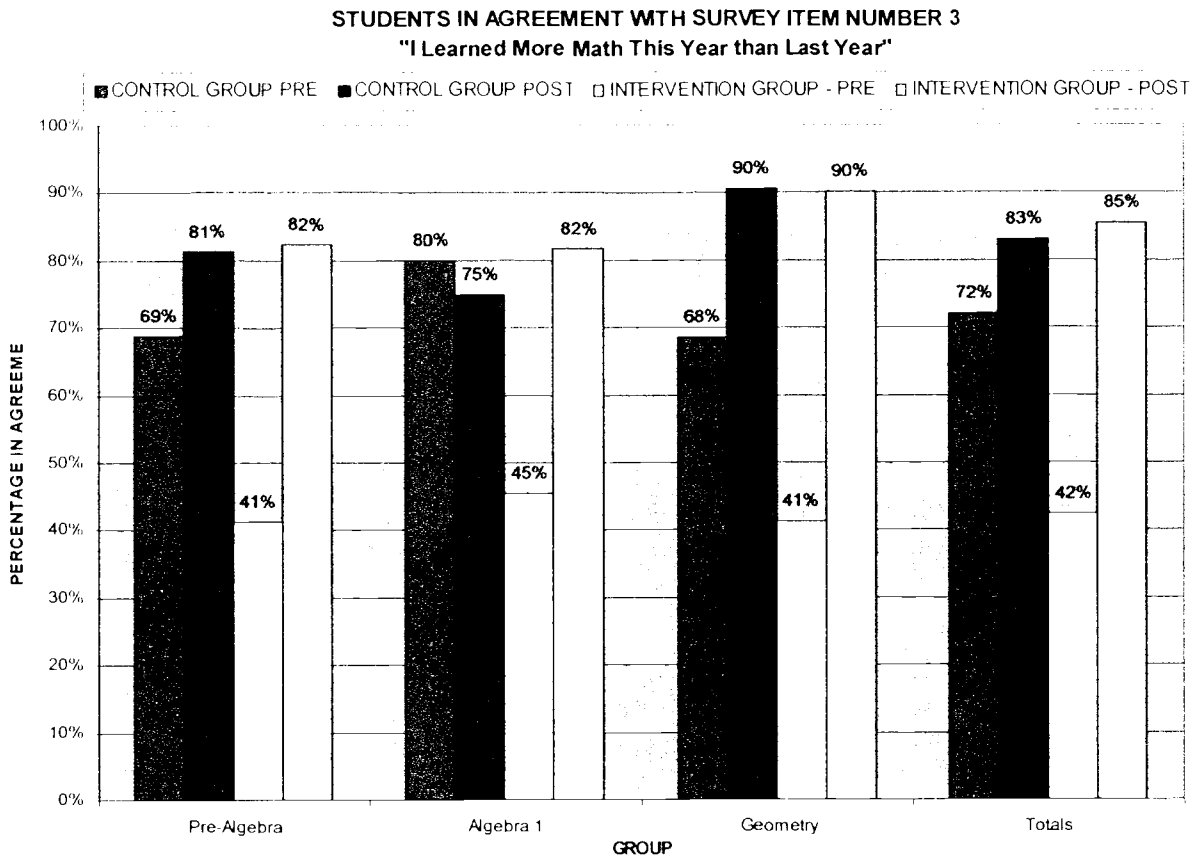

Figure 3. Percentages of students in agreement with statement number three.

Each intervention group initially responds with a much lower percentage of students in agreement than the corresponding control group. Every intervention group also ends the study with a percentage of agreement that is greater than or equal to that of the corresponding control group. Overall, the total intervention group more than doubles the amount of students that are in agreement with the statement "I learned more math this year than I did last year." This is an increase of 43%. The total control group also shows an increase in the percentage of students in agreement with that statement (11%). The only group that shows a decrease in agreement is the control group for Algebra 1, which shows a decrease of 5%.

The fifth item on the student survey states, "The pace of this math class is just right." This particular item shows major changes in responses from one-half of the classes participating in the study. This is illustrated in Figure 4.

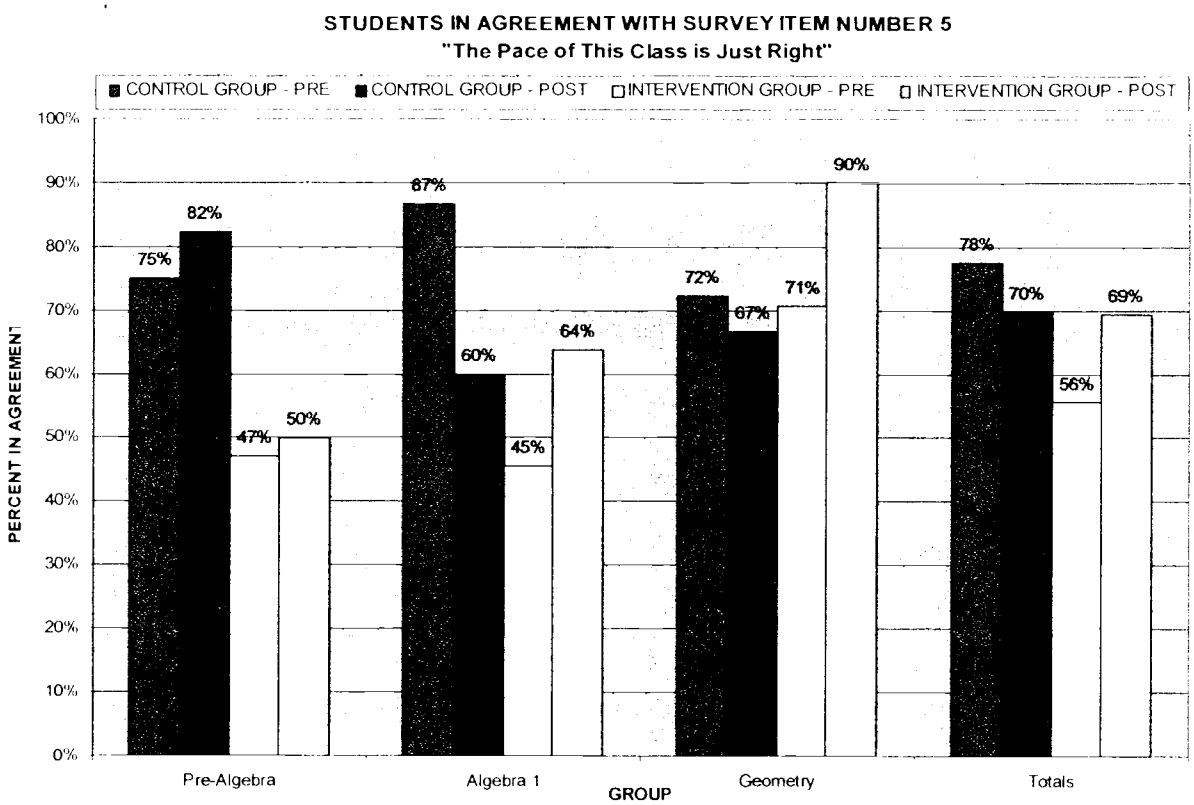

Figure 4. Percentages of students in agreement with survey item number five.

In the initial survey, all of the intervention groups show a lower percentage of students in agreement with the pace of the class than the control groups. There is a particularly large difference found among the pre-algebra and Algebra 1 groups. Overall, the control group has 22% more students than the intervention group that are in agreement with the pace of the class prior to the study. At the end of the study, the total control and intervention groups have a difference of only 1% in the students that are in agreement with the class pace.

The pre-algebra control and intervention groups both show a small increase in agreement with item five. Greater changes are noticeable in Geometry and Algebra 1. The control group for Algebra 1 demonstrates a decrease of 27% in the number of students that believe the pace of the class was just right. However, the intervention groups for the Algebra 1 and Geometry classes show a major increase in the percentage of students that agree with that statement. The intervention group for Algebra 1 posts an increase of 18%, and the geometry intervention group shows a 19% increase. The total control group displays a decrease of 8%, and the total intervention group shows an increase of 13% of the students who are in agreement with the pace of the class.

The sixth item on the survey measures the amount of time that students spend on math homework each week. The graph in Figure 5 shows percentages of students who spend two hours or less on homework per week.

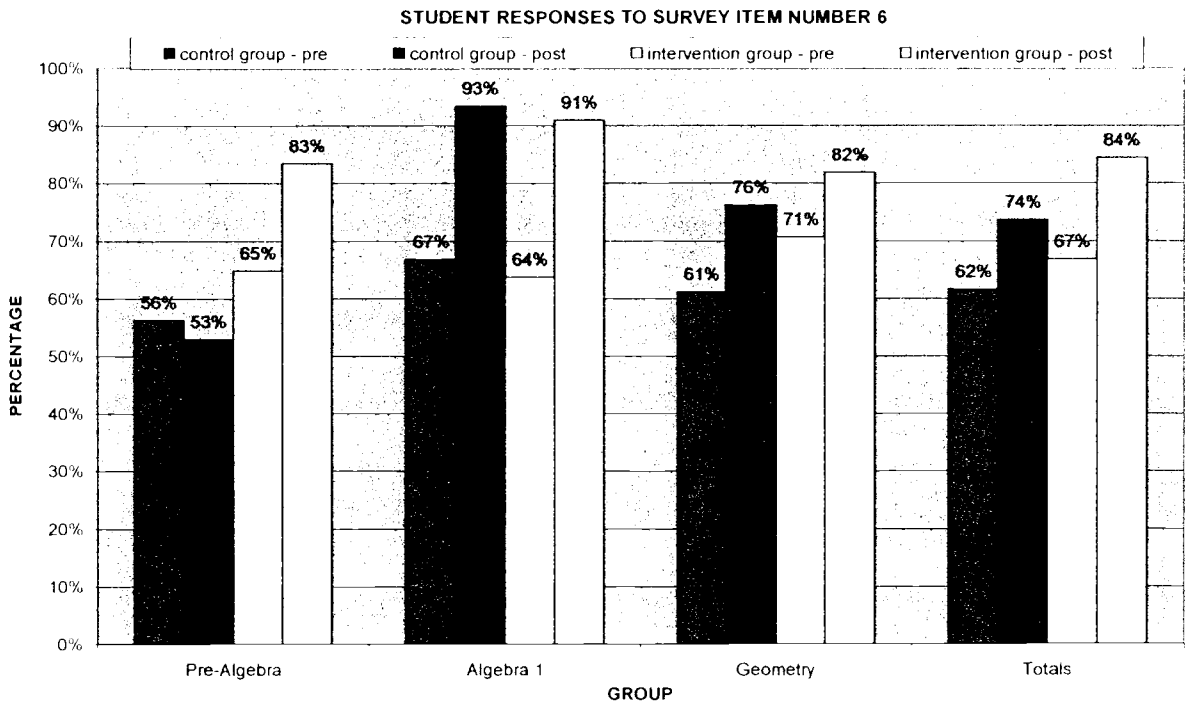

Figure 5. Percentages of Students who spend 0-2 on math homework each week.

The percentage of students who spend zero to two hours per week on homework increases for five out of the six classes taking the survey. This shows that, on the average, students are spending less time on homework. The only group that spends more time on homework is the pre-algebra control group. Overall, the total intervention group increased the percentage of students spending less time on homework by 18%, and the total control group increased the percentage of students spending less time on homework by 12%. Both the control and intervention groups for algebra 1 show the largest increase of students spending less time on homework (27%).

The major changes in results from the pre-survey to the post-survey are detailed within this paper. Data and graphs of all changes for survey items one through six are detailed in Appendix D.

The second survey taken by the intervention groups contains four additional items that are specifically related to the Accelerated Math program. These statements are

7. I like math better this year than last year.
8. It was easy to learn how to use the computer.
9. I learn math better with the computer instead of only with a book.
10. I feel confident that I can pass the tests that the computer gives me.

Student responses to these items are reported in percentage of students that agree with each statement. There is no comparison from pre- to post-survey, as these items are not on the initial survey. The results are seen in Figure 6.

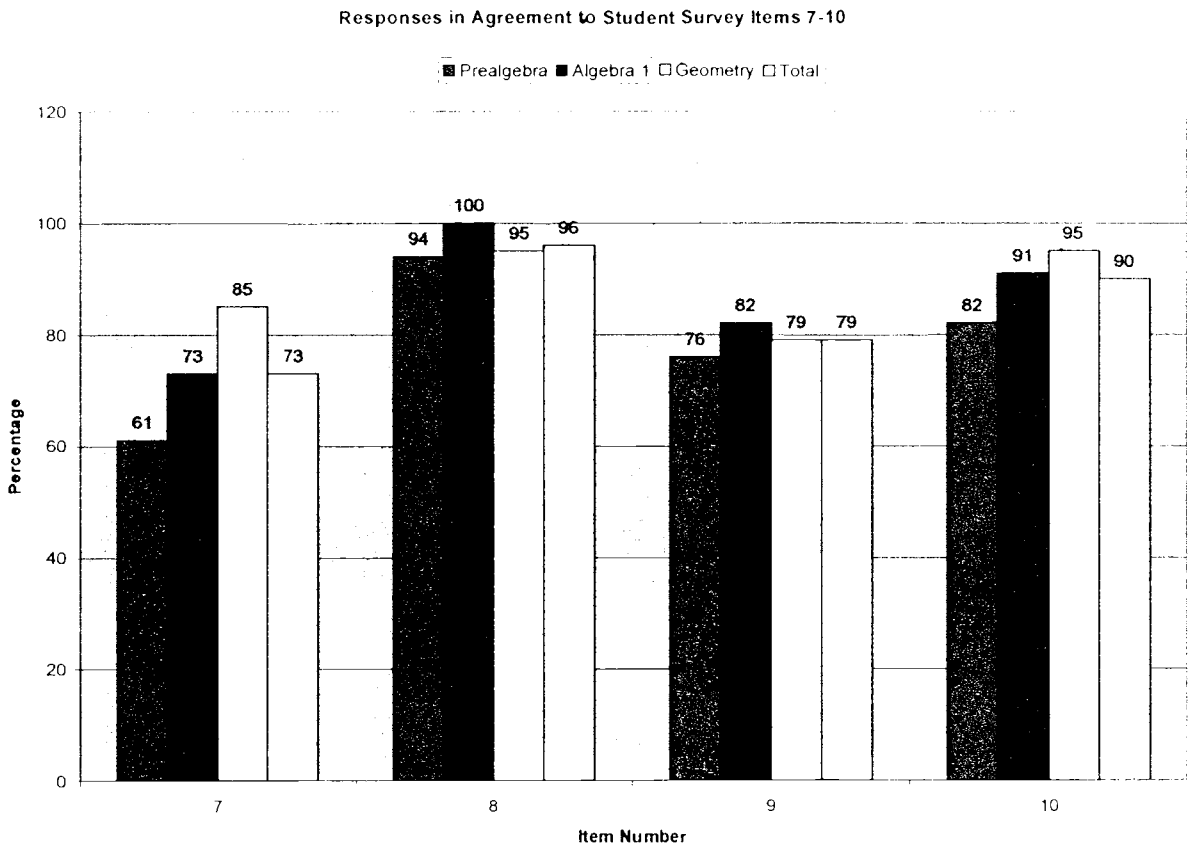

Figure 6. Percentages of students that agree with survey items 7-10.

In responding to statements regarding the Accelerated Math program, seventy-three percent of the students working with that program say that they like math better this year than last year. Ninety-six percent of the students agree that it is easy to learn the computer. Seventy-nine percent of the students like math better with a computer rather than just a book. And finally, ninety percent of all students using the Accelerated Math program are confident they will pass the tests that the computer gives them.

The post-surveys for students involved in the intervention ask for written comments regarding the Accelerated Math ™ program. The number of favorable and unfavorable responses for each class can be seen in Table 5.

Table 5

Student Comments Regarding the Accelerated Math Program

Class	Favorable	Unfavorable	Total
Pre-Algebra	14	2	16
Algebra 1	11	0	11
Geometry	17	4	21
Total	42	6	48

Almost all of the students in the intervention groups have responded with written comments on their surveys. Forty-two out of forty-eight of these comments are positive. Some of these favorable comments are included in the following list.

- I like it because I can go at my own pace.
- I like being able to instantly find out how I did on my work.
- ...by teaching it to others, I learned the math better.
- It let me move ahead faster and I got more accomplished.
- I raised my grade (considerably).

Eighty-eight percent of the comments received from students involved in the Accelerated Math program are favorable. Only twelve percent of the comments from students in the intervention groups are unfavorable toward the Accelerated Math program. A complete listing of all student comments, by class, can be found in Appendix D.

Parent Surveys

Parent responses to the pre- and post-surveys are evaluated using a weighted average and a percentage of agreement. Responses are only selected for agreement if the parent responded "yes" on the survey. The remaining responses of "no", "about the same" and "don't know" are not included in the percentage of agreement reported. Responses to item number six on the parent survey are calculated the same way as responses to item number six on the student survey. The specific items on the survey are

1. My child likes math more this year than last year.
2. My child is learning math better this year compared to last year.
3. My child is more confident in math this year compared to last year.
4. My child is more motivated to work on math this year compared to last year.
5. My child spends more time on math homework this year compared to last year.
6. My child averages the following number of hours on math homework each week.

Over seventy percent of the parents in the pre-algebra and geometry classes returned both the pre-survey and the post-survey. From the algebra 1 classes, less than fifty percent of the parents from the control group, and less than fifteen percent of the parents from the intervention group returned the surveys. For this reason, only pre-algebra and geometry classes are shown with individual class results. The algebra 1 parent surveys are included in the results

of the total control and total intervention groups, as appropriate. Table 6 shows the total differences observed in the percentage of agreement from pre-survey to post-survey.

Table 6

Difference (in percent) in Responses from Parent Pre-Surveys to Post-Surveys

Class/Treatment	Item No.	1	2	3	4	5	6
Pre-algebra	Control	22	14	25	0	0	-13
	Intervention	7	30	39	15	-16	0
Geometry	Control	13	28	6	-13	-2	0
	Intervention	31	31	9	13	-9	11
Total	Control	9	7	1	-12	-8	3
	Intervention	23	31	23	14	-13	6
Total gains in percent		103	138	103	17	-48	7

Item number two shows a greater percentage of change overall than any other item. It is the only item where more than one group shows a change of thirty percent or more. Figure 7 displays the parent responses for this survey item. Only responses of "Yes" to the statement "My child is learning math better this year compared to last year" are graphed.

All Pre-algebra and Geometry classes show an increase in the percentage of parents who believe their students are learning math better. The overall increase for the intervention groups is more than four times that of the increase for the control groups. The total intervention group shows a gain of

thirty-one percent in the number of parents who agree that their student is learning math better at the time of the post-survey. The total control group shows a gain of seven percent in this area.

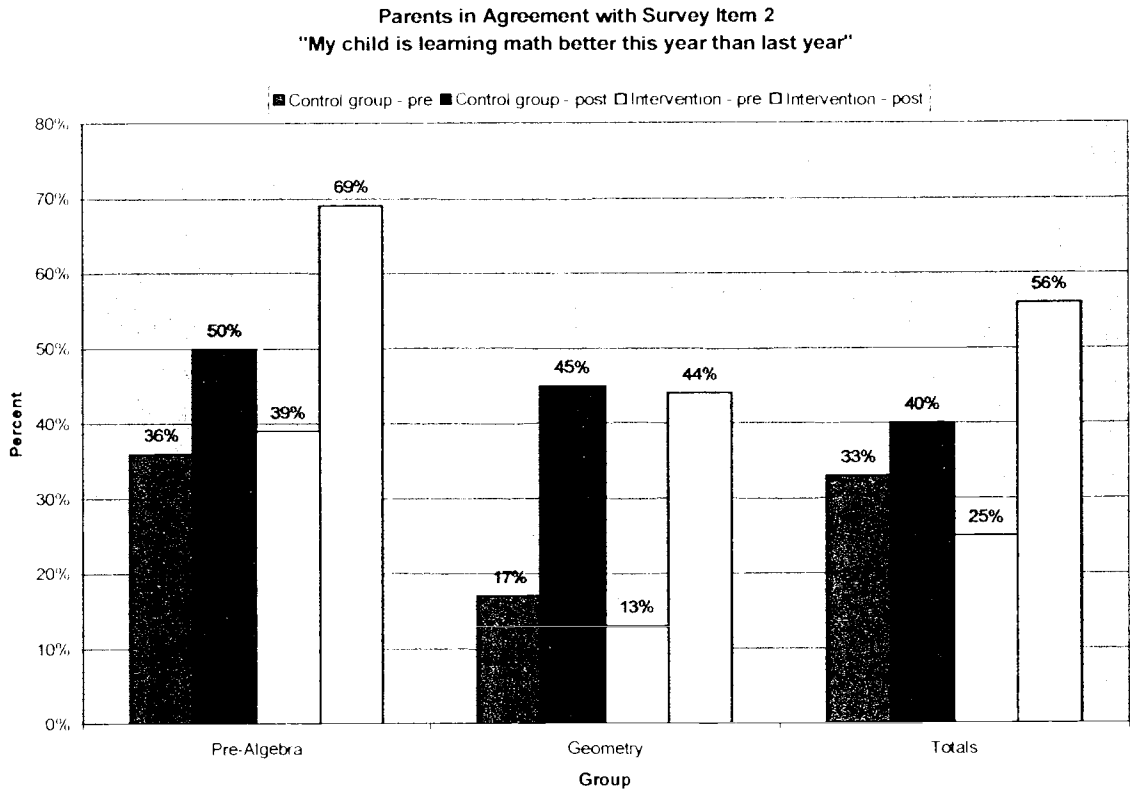

Figure 7. Parents who agree their child is learning math better this year.

The first item on the parent survey also reveals some major differences in parent responses from the pre-survey to the post-survey. Item one states "My child likes math more this year than last." Parents of students in the pre-algebra control group show a twenty-two percent increase of agreement in this area. The largest increase is found in the geometry intervention group. Parents of students in this class went from thirteen percent in agreement prior to the study, to forty-four percent in agreement at the end of the study. That is an increase in

agreement of thirty-one percent of the parents in that particular group. Overall, the percentage of parents who agree that their child likes math more this year increased by nine percent for the control group, and increased by twenty-three percent for the intervention group. The total intervention group shows an increase that is more than double the increase shown by the control group. This information can be seen in Figure 8.

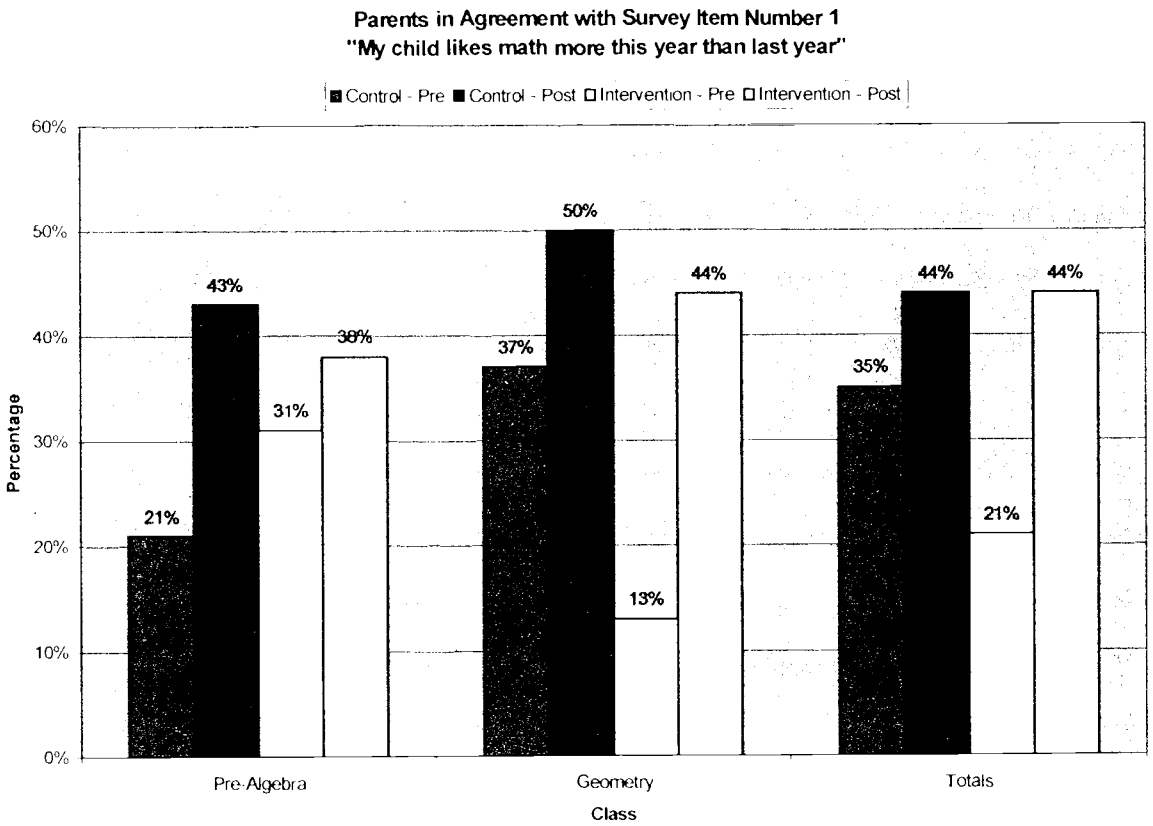

Figure 8. Parents who agree their child likes math more this year than last year.

The third item in the parent survey states "My child is more confident in math this year compared to last year." Major differences occur in the percentage of parents who agree with this statement from the pre-survey to the post-survey. All classes show improvement in this area, as illustrated in Figure 9. The most

noticeable difference occurs in the intervention group for the pre-algebra class. This particular class shows an increase of thirty-nine percent more parents in agreement with that statement at the conclusion of the study. The total intervention group shows twenty-three percent more parents believe that their child is more confident in math following the treatment. The total control group remains almost constant, showing an increase of one-percent following the study.

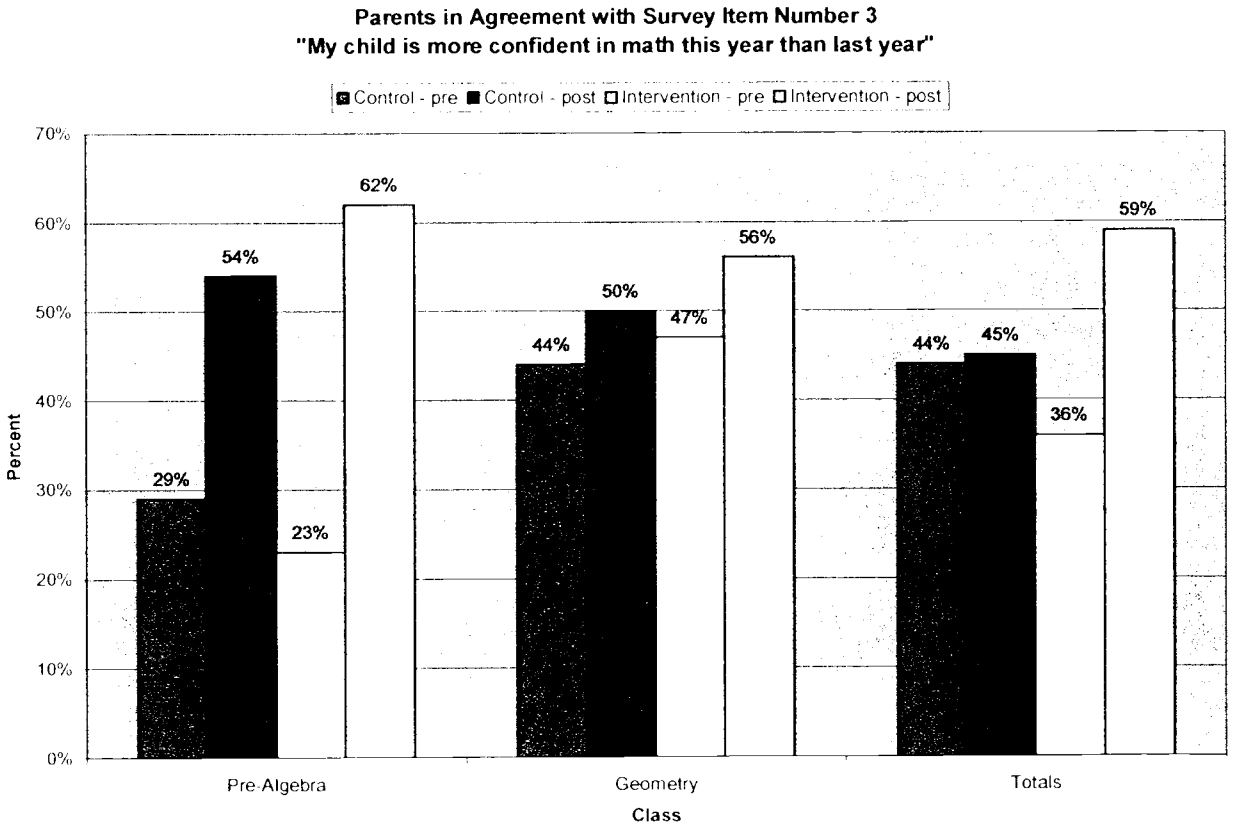

Figure 9. Percentages of parents who agree their child is more confident in math.

The three items with the greatest overall variance from pre-survey to post-survey are items one, two and three on the parent surveys. These items include; "My child likes math more this year than last year", "My child is learning math

better this year compared to last year", and "My child is more confident in math this year compared to last year". In all three cases, the overall intervention group shows more than twice the gains of the overall control group.

Parents are also asked to write any comments they would like to share at the end of the survey. Only ten parents of students in the intervention groups have written responses on their surveys. Table 7 shows a summary of favorable and unfavorable responses.

Table 7

Parent Comments Regarding the Accelerated Math Program

Class	Favorable	Unfavorable	Total
Pre-Algebra	3	2	5
Algebra 1	0	0	0
Geometry	2	3	5
Total	5	5	10

Only nine parents, about 19%, have written responses on their surveys. One parent has one favorable and one unfavorable comment. Five of the total parent responses are favorable and five are unfavorable. The two unfavorable pre-algebra parent responses contain a concern about not using a textbook and seldom having homework. The three geometry concerns include the multiple-choice format, the ability to retain the knowledge long-term, and the availability of the teacher for all students. The algebra 1 class has no parent comments. A complete listing of all parent comments, by class, is found in Appendix D.

Teacher Surveys

The post-surveys for the three teachers contain sixteen selected response items and eight short-answer questions. Table 8 is a summary of the teachers' responses to the first sixteen items. The complete results of both the selected response items and the written responses are located in Appendix D.

Table 8

Teacher Survey Results for Questions 1 – 16

Response	SA	A	D	SD	DK
Total Number	14	24	5	2	3
Total Percent	29%	50%	10%	4%	6%

The teachers agree with the survey statements seventy-nine percent of the time, they disagree fourteen percent of the time and are undecided six percent of the time. The strongest agreement is found for item number fifteen. All three teachers strongly agree that they spend less time grading papers and keeping records while using the Accelerated Math ™ program. In addition to that, all three teachers either strongly agree or agree with the following eight statements.

- My students are learning math skills better this year.
- My students are more confident in math this year.
- My students enjoy math more this year.
- My students take more responsibility for their math work this year.
- I am better able to deal with my students' different ability levels this year.

- I am better able to diagnose and correct individual student difficulties this year.
- The information provided by Accelerated Math enables me to teach more effectively than in previous years.
- I spend more time teaching and helping individual students this year.

Six of the survey statements have two teachers that are in agreement. Item number nine, "My students' math time is more productive this year," has two teachers in agreement and one teacher that responds "don't know". Two teachers agree and one teacher disagrees with the following five statements.

- My students are learning higher-order thinking and problem-solving skills better this year.
- My students are progressing through math topics faster this year.
- My students are more motivated to work at math this year.
- My students spend more time doing math this year.
- My students are helping each other more and working more cooperatively this year.

There is one survey item that no teacher agrees with. Item number eleven states; "I have fewer discipline problems in math class this year." Two teachers disagree with that statement and one teacher responds "don't know".

Overall, every teacher agrees with nine of the statements, two out of three teachers agree with six of the statements and one statement has no teachers in agreement. Additional survey responses to the short-answer questions provide further insight into the classroom structure and environment (See Appendix D).

Discussion

The purpose of this study is to evaluate the relationship between the use or non-use of the Accelerated Math program and students' skills in pre-algebra, algebra 1, and geometry. Secondly, student perceptions regarding mathematics are investigated. The benefit of this study is that it specifically addresses the use of the Accelerated Math program at the high school level. The majority of observations currently available regarding this program relate to elementary and middle school students (Institute, 1999; Spicuzze & Ysseldyke, 1999). These studies show strong gains in mathematical achievement for elementary and middle school students using the Accelerated Math program. Table 9 shows a comparison of the mean gains in NCEs from two of these studies with the mean gains in NCEs found in this study. The Minneapolis schools use the Northwest Achievement Level Test (NALT), and this study uses the Stanford 9 Achievement Test (SAT9). All three studies show results for the STAR Math Assessment.

Table 9

Results of Three Separate Studies Involving the Accelerated Math Program

School / Location / Grade Level	(n)	NCE Gain (Test)	Months	Gain/Month
Minneapolis Public School	181	5.3 (NALT)	5	1.06
Minneapolis, MN (4^{th}-5^{th})	181	5.4 (STAR)	5	1.08
Minneapolis Summer School	139	5.51 (NALT)	1.3	4.24
Minneapolis, MN (6^{th}-8^{th})	139	2.64 (STAR)	1.3	2.03
Buhler High School	48	10.1 (SAT9)	3.5	2.89
Buhler, KS (9^{th}-11^{th})	50	5.6 (STAR)	3.5	1.60

The average NCE gains per month for this study are greater than the 4th and 5th grade group from the Minneapolis Public School study, and less than the 6th - 8th grade group from the summer school program. It is reasonable that the summer school group would have higher gains per month as this type of setting is more intensive, and longer class periods provide for more time on task each day. The important thing to remember is that the mean gains in NCEs shown in this study are consistent with the results shown for mean gain in NCEs with other studies.

Additional studies with similar gains are also available (Institute, 1999). However, they are not used for comparison here because they use gains in percentile rank and grade equivalent rather than NCEs. Additionally, they are conducted for the purpose of studying Accelerated Math at the elementary level.

This study is beneficial in that it compares the results of the intervention group to a control group. In the teaching profession, gains in achievement are expected, regardless of the process used for instruction. By using a control group, we can observe the gains that take place with traditional instruction and compare them with the gains that take place while using the Accelerated Math program. An additional benefit found here is that the teacher for the control and intervention groups for each class is the same. Therefore, the limitation of different teacher effect may be eliminated, and it is possible to focus on the difference in mean gains found for each group.

The results of this study show that students using a computer managed learning system, specifically the Accelerated Math program, achieve higher mean

gains than students receiving traditional classroom instruction for all three classes. A closer analysis of this data reveals some interesting observations.

Achievement Test Results

In the initial study, designed to evaluate mean gains in achievement, the mean gains of the total intervention group are more than twice the mean gains of the total control group. This is true for every statistic on both the Stanford 9 Achievement Test and the STAR Math Assessment. As a result of these large differences, it was decided to determine the level of statistical significance for each individual group. Table 10 shows the z-score (from a paired-sample sign test) and the level of significance (using a one-tailed test) for the Stanford 9 Achievement Test NCE scores.

Table 10

Inferential Statistics for the Stanford 9 Achievement Test NCE Scores

Class/Treatment	z-score	alpha level
Pre-algebra		
Control	1.5	$p < .04$
Intervention	2.5	$p < .01$
Algebra 1		
Control	-0.26	$p < .40$
Intervention	2.11	$p < .02$
Geometry		
Control	2.24	$p < .02$
Intervention	4.12	$p < .001$

While it is not acceptable practice to determine levels of significance without establishing an alpha level prior to the study, the results are noteworthy. It is expected that both treatments would provide gains in student achievement, as that is what teaching is all about. What is interesting is the fact that all three intervention groups show significant gains ($p < .01$, $p < .02$, $p < .001$). And while two of the control groups demonstrate gains as well, they are not at the same level of significance ($p < .04$, $p < .40$, $p < .02$) as the intervention groups. This could lead to the conclusion that using the Accelerated Math program may provide greater gains in achievement for high school mathematics students than the traditional method of teacher lecture followed by student assignment.

While gains in achievement would be expected in all classes, the control group for algebra 1 does not show any mean gains in student achievement. This may occur for various reasons. First, this particular class is comprised mostly of students who could be considered "at risk" students. High absenteeism and low parent involvement may be a hindrance for these students. Additionally, two students in this particular class skewed the data by not taking the post-tests seriously. Their behavior during the tests, as well as their scores, indicates a lack of concern regarding their progress. One student shows a decrease of 37.5 NCEs (61.7 to 24.2) from pre-test to post-test, and the second shows a decrease of 17.7 NCEs (41.9 to 24.2). Recalculating the mean gains for the class without these two scores shows an average decrease of 2.8 NCEs rather than a decrease of 6.1 NCEs when their scores are included. Thus, two students made a difference of 3.3 NCEs in the mean for the class. Removing just two scores

dramatically decreases the mean loss in NCEs for that class. However, removing the scores of those two students from the total control group, only changes the total mean NCEs for the control group by 0.19 NCEs.

It is important to note the composition of the students in the algebra 1 classes. The teacher for this particular class has three classes of algebra 1 students. Two classes are comprised of students who could be considered "at risk", and one class would be considered "highly motivated" and "above average". In an attempt to maintain the integrity of the study, the two groups that are most similar (the two "at risk" classes) are chosen for the control and intervention groups. Initially, the intervention group ranks lower in achievement than the control group, and receives less parental involvement (not even one parent from this group responds to the parent pre-survey). However, at the end of the study, the intervention group of "at risk" algebra 1 students shows mean gains in achievement, while the control group of "at risk" algebra 1 students does not. One might conclude that using an individualized, computer-managed instructional program for "at risk" high school mathematics students could help promote mean gains in achievement for those students.

The pattern of mean gains seen on the STAR Math Assessment is similar to the pattern of results seen on the Stanford 9 Achievement Test. As both tests measure achievement, consistent results should be obtained, and help to validate the findings. However, there are some differences in content that should be taken into consideration while examining the results. The Stanford 9 Achievement Tests that are given in this study (Task 1 and Task 2) test students'

skills in basic math, algebra and geometry, and a calculator is permitted. The STAR Math Assessment provides an overall assessment of students' general mathematical ability, and the use of a calculator is not permitted. This information is important knowledge to use when interpreting the results.

For example, the geometry control and intervention groups do not show nearly as much gain on the STAR Math Assessment (1.4 NCEs and 5.5 NCEs) as they do for the Stanford 9 Achievement Test (8.8 NCEs and 16.6 NCEs). These differences in results are reasonable when one understands that the Stanford 9 Achievement Test is more likely to test geometry students over content they are currently studying, and that most of these students will have acquired the basic mathematical skills needed by this time. Even with these thoughts in mind, the major differences in mean gains between the control group and the intervention group are significant. It appears that the use of the Accelerated Math program in geometry not only increases students' geometric skills more rapidly, it also may serve to help students review and improve on their basic skills more effectively than traditional classroom instruction.

An evaluation of the pre-algebra scores shows that the pre-algebra intervention group has a higher mean gain than any other intervention group for the STAR Math Assessment. In addition, the pre-algebra control group has a higher mean gain than any other control group for the same test. Again, this is reasonable to expect when one realizes that the STAR Math Assessment measures achievement in basic mathematical skills. These concepts comprise more of the curriculum content in pre-algebra than in the other courses.

While both pre-algebra groups out-perform their counterparts in average mean gains in NCEs on the STAR Math Assessment, it is obvious that the pre-algebra group using the Accelerated Math program shows significantly higher gains than the traditional control group. The gains for the intervention group are more than two times greater than the gains for the control group regarding increase in basic mathematical skills. Once again, it appears that using a computer managed learning system, like Accelerated Math, may increase students' basic mathematical skills more quickly than utilizing traditional methods of classroom instruction.

Survey Results

The second aspect of this study is to investigate student attitudes about mathematics. It is interesting to see the changes in student perceptions from the pre-survey to the post-survey. Again, the intervention groups show much greater gains in positive agreement than the control groups, as is shown in the results section of this paper.

There are not significant gains in student agreement with the statements "I like math" (survey item 1), and "I think I am good at math" (item 2). Regardless of this fact, however, many students do agree with the statement "I learned more math this year than I did last year" (item 3). The control groups show a total gain of 11% in students who agree that they learned more, and the total intervention group shows a gain of 43% in the number of students who feel this way. This gain of almost four times the control group is possible because of the very low percentage of students in the intervention groups who initially agree with this

statement. It is interesting to relate the results of survey item three, "I learned more math...", with the results of survey item number five, "The pace of this math class is just right." Initially, every intervention group has a lower percentage of students in their class who agree with that statement than do the control groups. Only 56% of the students in the total intervention group feel that the pace of the class is just right for them. However, by the end of the study, 69% of the intervention group agrees with the pace of the class, and 85% perceive that they have learned more math. Apparently, students believe that they learn more math when the pace of the class is tailored to meet their individual needs.

It is also interesting to compare the amount of time students spend on homework (survey items 4 and 6) to their perceptions regarding the pace of the class and the amount of math they learned. Students in the intervention group actually spend less time on homework than the students in the control group, and yet they show increases in their perceptions that they are learning more math, and that the pace of the class is just right. In addition to that, the mean gains in NCEs from the achievement tests support they finding in the surveys by also demonstrating greater gains in achievement for the group that is spending less time on homework.

In the written comments, numerous students related that they like the Accelerated Math program because it allows them to work at their own pace and receive immediate feedback. A computer managed learning system seems to provide many benefits, which may enable students to experience increased productivity in high school mathematics classes.

The results of the parent surveys are similar to the results of the student surveys. Parents of both the control and intervention groups perceive their children to be learning math better, liking math better, and showing more confidence in math. Again, this is what all teachers would hope for, regardless of the process used for instruction. However, it is interesting to note, once again, that the gains in number of parents that agree are much greater for the intervention groups. The control group shows gains of 9%, 7% and 1%, respectively, for the first three survey items. In contrast, the intervention group shows significantly higher gains of 23%, 31%, and 23%. The parents' perceptions of their students' confidence and achievement show much greater improvement for those using the Accelerated Math program than for those who receive traditional classroom instruction.

When parents respond to statements regarding their child's motivation and time spent on homework, the results again are similar to the student responses. The motivation level decreases for the control group and increases for the intervention group. Most classes also show a decrease in the amount of time spent on homework, with the intervention groups spending less time than the control groups. It is interesting that the parents of students in the intervention group perceive their student to spend less time spent on homework, and yet observe greater motivation, achievement and confidence than parents of children in the control group.

Conclusions

The results of this study show that using a computer managed learning system, specifically the Accelerated Math program, may provide many benefits for high school mathematics students. As one looks at the overall results of the study, the gains made by the intervention group are much greater than the gains of the control group. The intervention group outperforms the control group in the following areas. Greater achievement gains are observed in basic mathematical skills. Larger gains are also found for algebraic and geometric skill level. Increases in motivation and confidence are noticeable. Students and parents believe they learn math better with the Accelerated Math program than they do with traditional classroom instruction. And all of these increases are found while the students are perceived to be spending less time on homework.

The results of this study are noteworthy, even in the light of certain limitations. In order to generalize the results to all high school mathematics students, however, further study is suggested. This study has relatively small classes. Sample size is limited and only includes classes from one high school in one school district. Further study could include students from districts that are urban, suburban and rural. Additional research could be conducted for more advanced high school courses such as algebra 2, pre-calculus and calculus. While there are limitations in class size, sample size and population, significant changes are observed within this study. These large gains and the level of statistical significance observed may indicate that the use of the Accelerated Math program could prove beneficial for other high school mathematics students.

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Appendix A

Surveys

Math Survey

Student name _____

Grade _____

Check one: Boy ☐ Girl ☐

Teacher _____

Please indicate how much you agree with the following statements by circling your response.

1. I like math.

   Strongly Agree Agree Disagree Strongly Disagree

2. I think I am good at math.

   Strongly Agree Agree Disagree Strongly Disagree

3. I learned more math this year than I did last year.

   Strongly Agree Agree Disagree Strongly Disagree

4. I spent more time on math this year than I did last year.

   Strongly Agree Agree Disagree Strongly Disagree

5. The pace of this math class is just right.

   Strongly Agree Agree Disagree Strongly Disagree

6. I average the following number of hours on math homework each week.

   Less than 1 1 2 3 4 5 More than 5

Math Survey

Student name _____

Grade _____

Check one: Boy ❒ Girl ❒

Teacher _____

Please indicate how much you agree with the following statements by circling your response.

7. I like math.

   Strongly Agree Agree Disagree Strongly Disagree

8. I think I am good at math.

   Strongly Agree Agree Disagree Strongly Disagree

9. I learned more math this year than I did last year.

   Strongly Agree Agree Disagree Strongly Disagree

10. I spent more time on math this year than I did last year.

    Strongly Agree Agree Disagree Strongly Disagree

11. The pace of this math class is just right.

    Strongly Agree Agree Disagree Strongly Disagree

12. I average the following number of hours on math homework each week.

    Less than 1 1 2 3 4 5 More than 5

Math Survey

Student name _____

Grade _____

Check one: Boy □ Girl □

Teacher _____

Please indicate how much you agree with the following statements by circling your response.

1. I like math.

Strongly Agree Agree Disagree Strongly Disagree

2. I think I am good at math.

Strongly Agree Agree Disagree Strongly Disagree

3. I learned more math this year than last year.

Strongly Agree Agree Disagree Strongly Disagree

4. I spent more time on math this year than last year.

Strongly Agree Agree Disagree Strongly Disagree

5. The pace of this math class is just right.

Strongly Agree Agree Disagree Strongly Disagree

6. I average the following number of hours on math homework each week.

Strongly Agree Agree Disagree Strongly Disagree

7. I like math better this year than last year.

Strongly Agree Agree Disagree Strongly Disagree

8. It was easy to learn how to use the computer.

Strongly Agree Agree Disagree Strongly Disagree

9. I learn math better with the computer instead of only with a book.

Strongly Agree Agree Disagree Strongly Disagree

10. I feel confident that I can pass the tests that the computer gives me.

Strongly Agree Agree Disagree Strongly Disagree

11. If you liked doing math with the computer, please tell us why.

_____

_____

_____

Parent Survey

Parent _____ Date _____

Child _____

Boy ☐ Girl ☐

Teacher _____

We are interested in what you think about your child's math experience for first semester this year compared to previous years. Please circle your response to the following statements.

1. My child likes math more this year than last year.

   Yes No About the same Don't know

2. My child is learning math better this year compared to last year.

   Yes No About the same Don't know

3. My child is more confident in math this year compared to last year.

   Yes No About the same Don't know

4. My child is more motivated to work on math this year compared to last year.

   Yes No About the same Don't know

5. My child spends more time on math homework this year compared to last year.

   Yes No About the same Don't know

6. My child averages the following number of hours on math homework each week.

   Less than 1 1 2 3 4 5 More than 5 Don't know

Please write any comments you may have:

_____

_____

_____

_____

_____

Parent Survey

Parent _____ Date _____

Child _____

Boy ☐ Girl ☐

Teacher _____

We are interested in what you think about your child's math experience for second semester this year compared to first semester. Please circle your response to the following statements.

1. My child likes math more this year than last year.

   Yes No About the same Don't know

2. My child is learning math better this year compared to last year.

   Yes No About the same Don't know

3. My child is more confident in math this year compared to last year.

   Yes No About the same Don't know

4. My child is more motivated to work on math this year compared to last year.

   Yes No About the same Don't know

5. My child spends more time on math homework this year compared to last year.

   Yes No About the same Don't know

6. My child averages the following number of hours on math homework each week.

   Less than 1 1 2 3 4 5 More than 5 Don't know

Please write any comments you may have:

_____

_____

_____

_____

_____

Parent Survey

Parent _____ Date _____

Child _____

Boy ☐ Girl ☐

Teacher _____

Your child has been using the Accelerated Math computer program in his/her math class this semester. We are interested in what you think about your child's math experience for second semester this year compared to first semester. Please circle your response to the following statements.

1. My child likes math more this year than last year.

   Yes No About the same Don't know

2. My child is learning math better this year compared to last year.

   Yes No About the same Don't know

3. My child is more confident in math this year compared to last year.

   Yes No About the same Don't know

4. My child is more motivated to work on math this year compared to last year.

   Yes No About the same Don't know

5. My child spends more time on math homework this year compared to last year.

   Yes No About the same Don't know

6. My child averages the following number of hours on math homework each week.

   Less than 1 1 2 3 4 5 More than 5 Don't know

Please write any comments you may have:

_____

_____

_____

_____

Accelerated Math Teacher Survey

Name _____ Date _____
Grade _____

Please compare this year's teaching experience using Accelerated Math with your past math teaching experiences. Feel free to elaborate on your responses by writing comments, using additional paper if necessary.

1. My students are learning basic math skills better this year.

   Strongly Agree Agree Disagree Strongly Disagree Don't know

2. My students' are learning higher-order thinking and problem-solving skills better this year.

   Strongly Agree Agree Disagree Strongly Disagree Don't know

3. My students are progressing through math topics faster this year.

   Strongly Agree Agree Disagree Strongly Disagree Don't know

4. My students are more confident in math this year.

   Strongly Agree Agree Disagree Strongly Disagree Don't know

5. My students enjoy math more this year.

   Strongly Agree Agree Disagree Strongly Disagree Don't know

6. My students are more motivated to work at math this year.

   Strongly Agree Agree Disagree Strongly Disagree Don't know

7. My students take more responsibility for their math work this year.

   Strongly Agree Agree Disagree Strongly Disagree Don't know

8. My students spend more time doing math this year.

   Strongly Agree Agree Disagree Strongly Disagree Don't know

9. My students' math time is more productive this year.

   Strongly Agree Agree Disagree Strongly Disagree Don't know

10. My students are helping each other more and working more cooperatively this year.

    Strongly Agree Agree Disagree Strongly Disagree Don't know

11. I have fewer discipline problems in math class this year.

    Strongly Agree Agree Disagree Strongly Disagree Don't know

12. I am better able to deal with my students' different ability levels this year.

    Strongly Agree Agree Disagree Strongly Disagree Don't know

13. I am better able to diagnose and correct individual student difficulties this year.

Strongly Agree Agree Disagree Strongly Disagree Don't know

14. The information provided by Accelerated Math enables me to teach more effectively than in previous years.

Strongly Agree Agree Disagree Strongly Disagree Don't know

15. I spend less time grading papers and keeping records this year.

Strongly Agree Agree Disagree Strongly Disagree Don't know

16. I spend more time teaching and helping individual students this year.

Strongly Agree Agree Disagree Strongly Disagree Don't know

17. Did you change the way you teach math because of using Accelerated Math? Please explain.

18. Did you keep your whole class together in their work using Accelerated Math, allow students to work at their own rates through the objectives, or have another system? Please explain.

19. Do you think Accelerated Math had a positive effect on girls' achievement in math, their attitude towards math, or their confidence? Please explain.

20. How would you describe student interactions in your math class? For example, were students helping each other informally? Were they working in assigned groups? Please explain.

21. Teachers using Accelerated Math have reported that students learn math through various combinations of whole-class lessons, one-on-one explanations, small group instruction, students learning on their own, students working cooperatively, or other means. How do students learn math in your class?

22. If your students spend more time doing math this year, is this due to an increase in the math period time, more efficient use of class time, or some other factor? Please explain.

23. Does Accelerated Math help prepare your students for high-stakes testing? Please explain. (This question may not apply to you.)

24. Please list the Accelerated Math reports that you find most valuable and briefly explain how you use them.

Appendix B

Parent Information Letter

BUHLER UNIFIED SCHOOL DISTRICT NO. 313 BUHLER, KANSAS

BUHLER HIGH SCHOOL

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316-543-2255 888-662-8802 (FAX) 316-543-2853

R. Larry Roberts
Principal

Steve Miller
Assistant Principal

Todd Dreifort
Assistant Principal
Athletic Director

Dear Parent:

Your child will be using a new computer software program, Accelerated Math, in pre-algebra this semester. We think that Accelerated Math will significantly improve mathematics learning by efficiently managing practice and testing and helping me identify individual needs. Here is how the program works:

- The program prints daily math work (practice sheets) for the students.
- Students complete their work using paper and pencil at their desks.
- Accelerated Math will correct student work and report the results immediately.
- The teacher will discuss the results with each individual student. If the practice objectives are mastered, the student will move ahead to other objectives. If problems are identified, Accelerated Math will generate another worksheet containing the objectives that are not mastered.
- After a student has successfully completed about 3-5 practice objectives, Accelerated Math will generate a test on those objectives. Successful testing will result in mastery of those objectives.

Accelerated Math will allow each student to have an individualized math program. It will also give me more time to teach and your child more time to practice math. We are confident that your child will benefit from this latest technology in mathematics education. If you have any questions, please call me.

Sincerely,

Mrs. Terri Gaeddert
Pre-algebra teacher

Appendix C

Additional Pre-test and Post-test Statistics

Mean Gains in Percentile Rank

Stanford 9 Achievement Test

The results of the mean gains in percentile rank (PR) for Stanford 9 Achievement Test can be seen in Table C1. Mean gains for the percentile rank are simply calculated by taking the total gain for the class and dividing by the number of students.

Table C1

Descriptive Statistics for Stanford 9 Achievement Test PR Scores

Class/Treatment	(n)	Pretest Mean	Posttest Mean	Mean Gain
Pre-Algebra				
Control	(16)	47.5	55.2	7.7
Intervention	(17)	48.1	60.0	11.9
Algebra 1				
Control	(15)	67.0	57.0	-10.0
Intervention	(11)	60.0	64.4	4.4
Geometry				
Control	(21)	66.4	77.1	10.7
Intervention	(20)	73.4	89.6	16.2
Total Group				
Control	(52)	60.8	64.6	3.8
Intervention	(48)	61.4	73.3	12.0

The statistical results for the gains in Percentile Rank shown on the Stanford 9 Achievement Test indicate that all intervention groups and two control groups show improvement. Increases range from an average gain of 3.8 to an average gain of 16.2 per class. One control group, algebra 1, shows an average decrease of 10.0 PRs. All intervention groups from the pre-algebra, algebra 1 and geometry classes display higher average gains than the control groups for those same classes. The total control group (not broken down by class) shows an average gain of 3.8 PRs, while the total intervention group reveals an average gain of 12.0 PR's. The entire intervention group shows an average gain of 8.2 PRs more than the entire control group. This information is illustrated in figure C1.

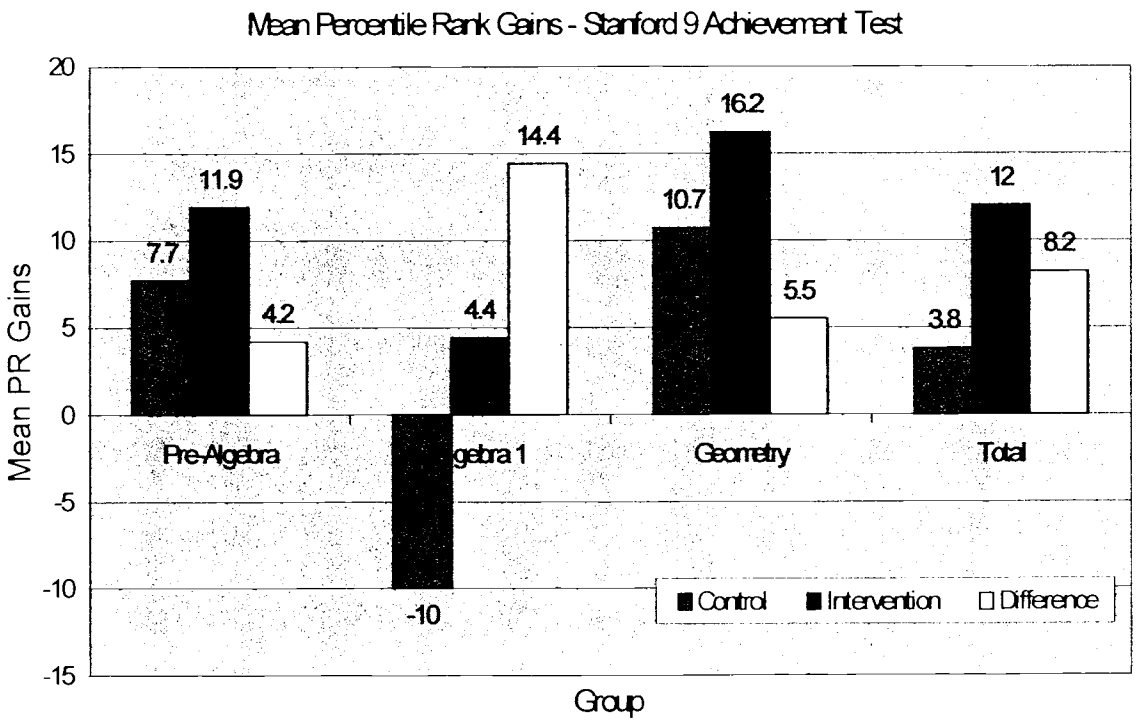


Figure C1. Mean PR Gains for the Stanford 9 Achievement Test

STAR Math Assessment

The STAR Math Assessment scores are shown in Table C2. In the STAR test, all intervention groups show gains in the average PR scores. These gains range from an average gain of 8 PRs to an average gain of 11 PRs. Two control groups also show mean gains of 2 and 4 PRs. The control group for algebra 1 has an average decrease of 3 PRs. This particular control group shows an average decrease in Percentile Rankings for both norm-referenced tests.

Table C2

Descriptive Statistics for mean PR gains on the STAR Math Assessment

Class/Treatment	(n)	Pretest Mean	Posttest Mean	Mean Gain
Pre-Algebra				
Control	(16)	30	34	4
Intervention	(19)	27	38	11
Algebra 1				
Control	(15)	41	38	-3
Intervention	(11)	41	49	8
Geometry				
Control	(21)	62	64	2
Intervention	(20)	66	75	9
Total Group				
Control	(52)	46.1	47.3	1.2
Intervention	(50)	45.7	55.2	9.5

A comparison of the mean gains in Percentile Rankings from the STAR Math Assessment depicts higher gains for the intervention groups than for the control groups in every subject area. The average of 9.5 PR gains in the total intervention group is 8.3 PRs higher than the average gain of 1.2 PRs for the total control group. This is illustrated in figure C2. In both the Stanford 9 Achievement Test and the STAR Math Assessment, the mean gain in Percentile Rank of the intervention group is more than double the mean gain in Percentile Rank for the control group.

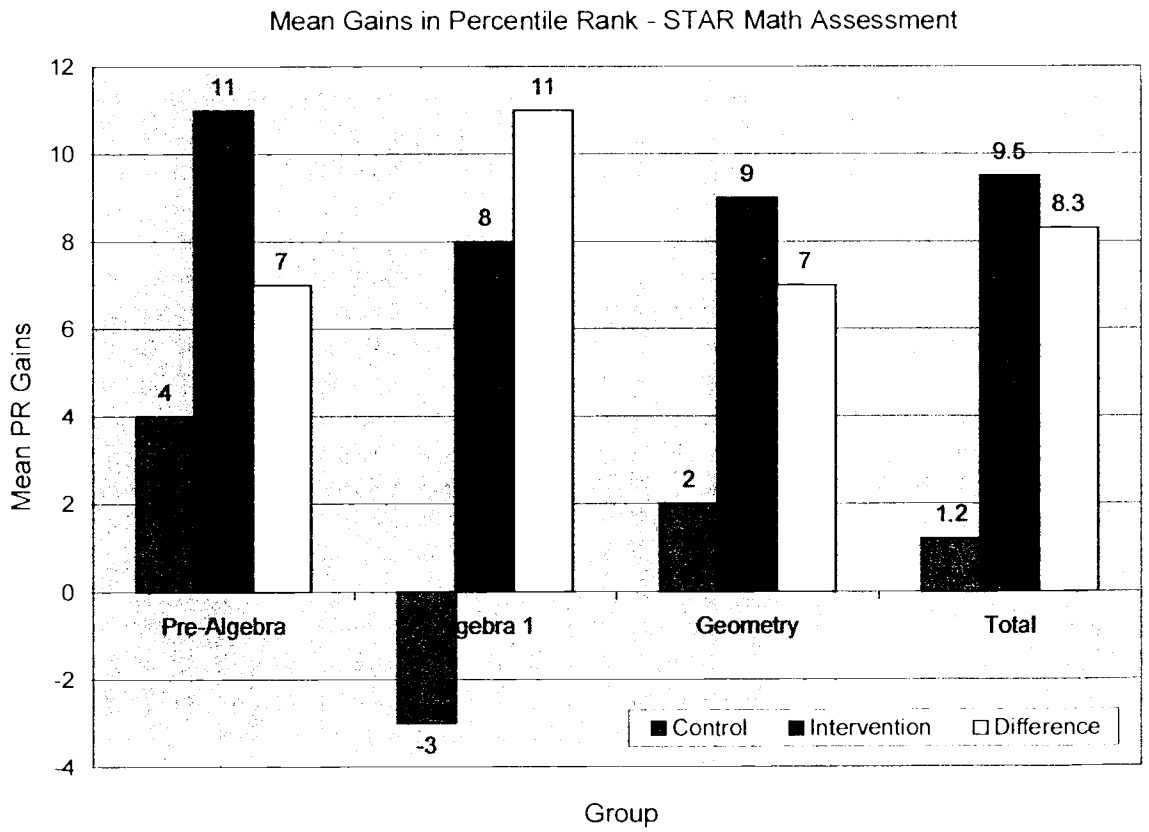


Figure C2. Mean gains in PR on the STAR Math Assessment

Mean Gains in Grade Equivalent

Stanford 9 Achievement Test

The results of the mean gains in grade equivalent (GE) scores for the Stanford 9 Achievement Test can be seen in Table C3. Mean gains in grade equivalent scores for the Stanford 9 are calculated by taking the total gain for the class and dividing by the number of students.

Table C3

Descriptive Statistics for Stanford 9 Achievement Test GE Scores

Class/Treatment	(n)	Pretest Mean	Posttest Mean	Mean Gain
Pre-Algebra				
Control	(16)	9.8	10.6	0.8
Intervention	(17)	9.7	11.1	1.4
Algebra 1				
Control	(15)	11.6	10.7	-1.0
Intervention	(11)	10.8	11.5	0.7
Geometry				
Control	(21)	11.6	12.4	0.8
Intervention	(20)	12.1	12.9	0.8
Total Group				
Control	(52)	11.0	11.3	0.3
Intervention	(48)	11.0	11.9	1.0

The gains shown in Grade Equivalent (GE) scores on the Stanford 9 Achievement Test indicate that all intervention groups and two control groups show improvement. Increases range from an average gain of 0.3 to an average gain of 1.4 per class. One control group, algebra 1, shows an average decrease of 1.0 GEs. All intervention groups from the pre-algebra, algebra 1 and geometry classes display average gains that are greater than or equal to the control groups for those same classes. The total control group (not broken down by class) shows an average gain of .3 in the grade equivalent category, while the total intervention group reveals an average gain of 1.0 in grade equivalent scores. The entire intervention group shows an average gain of .7 (about 7 months) more than the entire control group. This information is illustrated in Figure C3.

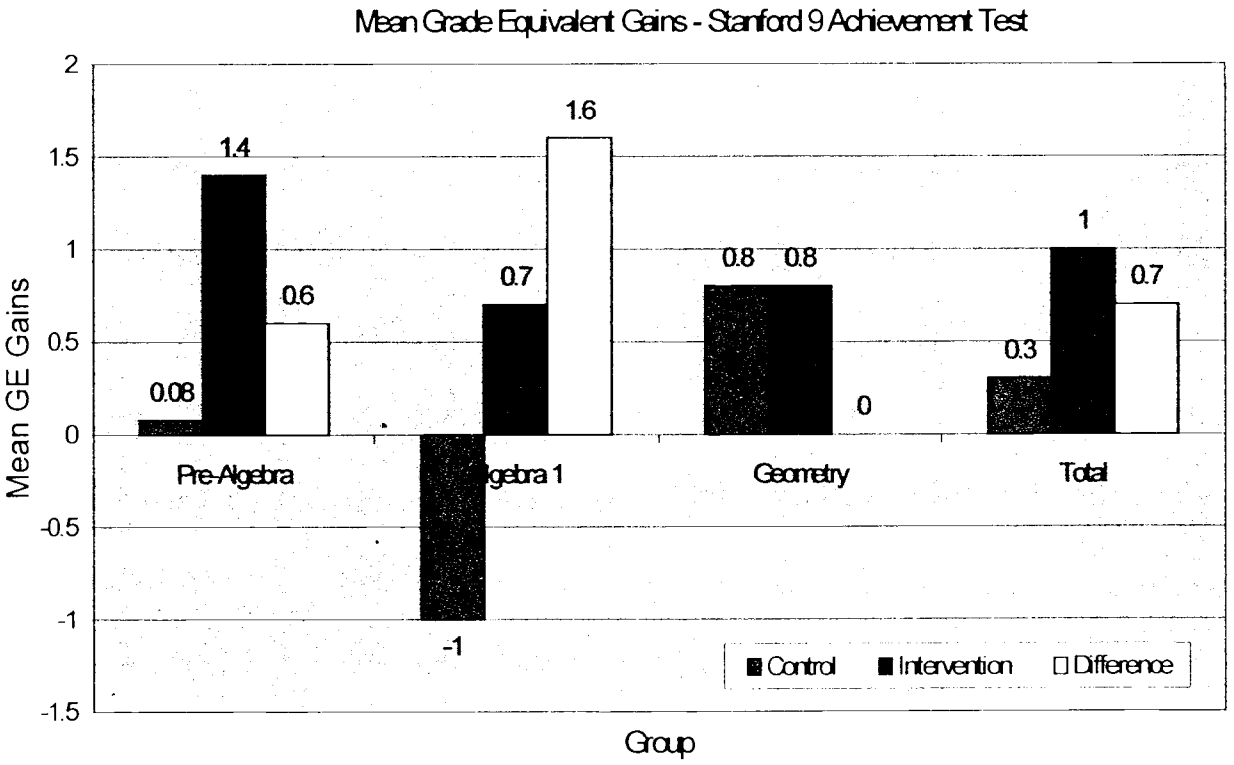


Figure C3. Mean GE Gains for the Stanford 9 Achievement Test

STAR Math Assessment

The STAR Math Assessment scores are shown in Table C4. All intervention groups show gains in the average grade equivalent scores. These gains range from an average gain of 0.4 GEs to an average gain of 1.6 GEs. Two control groups also show mean gains of 0.3 and 0.7 GEs. The control group for algebra 1 has an average decrease of 0.1 GEs. This particular group shows an average decrease in grade equivalent rankings for both assessment tests.

Table C4

Descriptive Statistics for mean GE gains on the STAR Math Assessment

Class/Treatment	(n)	Pretest Mean	Posttest Mean	Mean Gain
Pre-Algebra				
Control	(16)	7.1	7.8	0.7
Intervention	(19)	6.8	8.1	1.3
Algebra 1				
Control	(15)	8.6	8.5	-0.1
Intervention	(11)	8.8	10.4	1.6
Geometry				
Control	(21)	12.8	13.1	0.3
Intervention	(20)	12.7	13.1	0.4
Total Group				
Control	(52)	9.1	9.5	0.4
Intervention	(50)	9.2	10.4	1.2

A comparison of the mean gains in grade equivalent rankings from the STAR Math Assessment depicts higher gains for the intervention groups than for the control groups in every subject area. The average of 1.2 GE gains in the total intervention group is 0.8 (8 months) higher than the average gain of 0.4 GEs for the total control group. This is illustrated in figure C4. In both the Stanford 9 Achievement Test and the STAR Math Assessment, the mean gain in grade equivalent scores of the intervention group is more than triple the mean gain in grade equivalent scores for the control group.

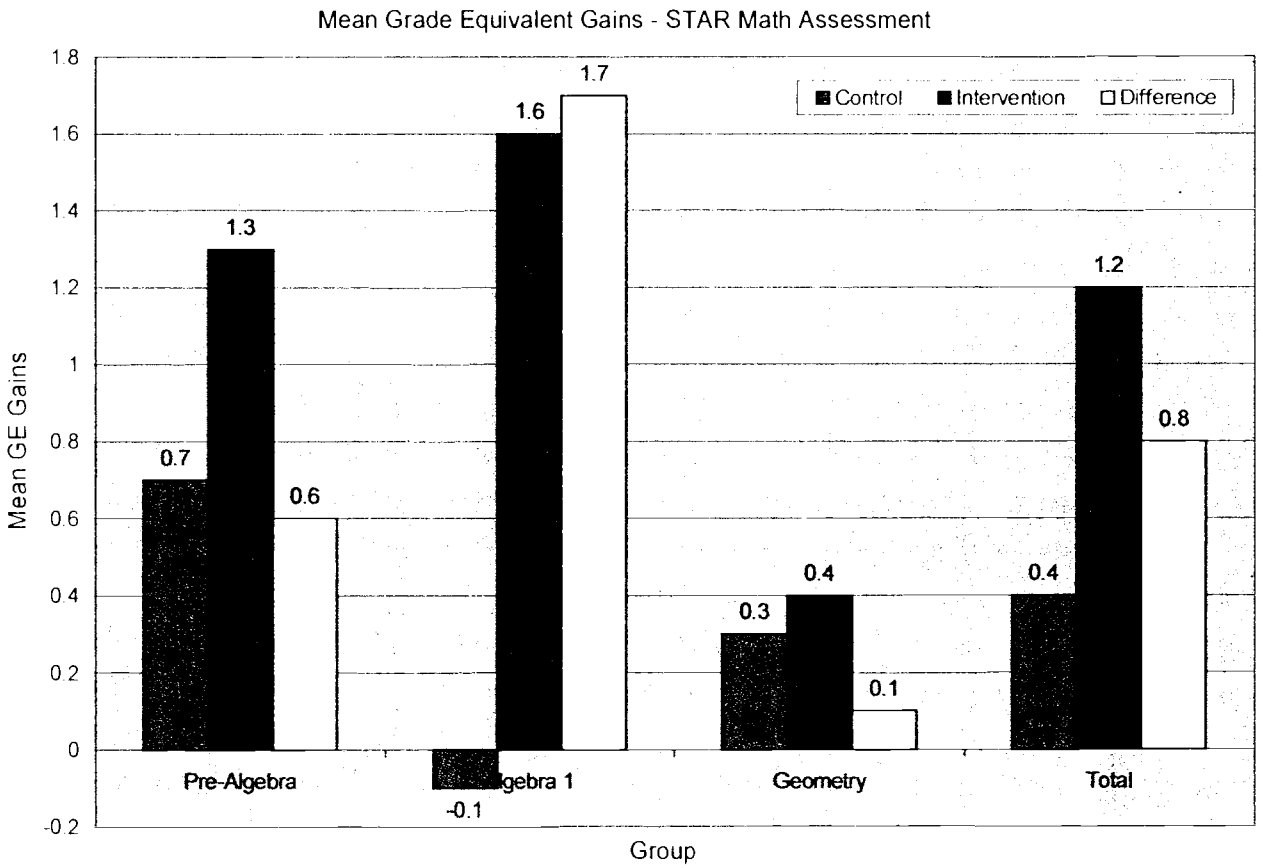


Figure C4. Mean gains in GE on the STAR Math Assessment

Appendix D

Additional Survey Results

Additional Student Survey Responses for Questions 1 - 6

Mean responses based on weighted values

Pre-Algebra

Item	Control			Intervention		
No.	Pre	Post	Gain	Pre	Post	Gain
1	2.5	2.5	0.0	2.4	2.2	-0.2
2	2.8	2.8	0.0	2.2	2.4	0.2
3	2.8	3.3	0.5	2.4	3.0	0.6
4	2.8	3.1	0.3	2.5	2.7	0.3
5	3.0	3.0	0.0	2.4	2.5	0.1
6	2.7	2.4	-0.3	2.8	3.4	0.6

Algebra 1

Item	Control			Intervention		
No.	Pre	Post	Gain	Pre	Post	Gain
1	2.6	2.4	-0.2	2.5	2.6	0.1
2	2.7	2.3	-0.4	2.5	2.7	0.3
3	2.9	2.8	-0.1	2.5	3.3	0.8
4	2.4	2.4	0.0	2.5	3.2	0.6
5	2.9	2.8	-0.1	2.4	2.7	0.4
6	2.9	3.5	0.5	2.8	3.6	0.8

Geometry

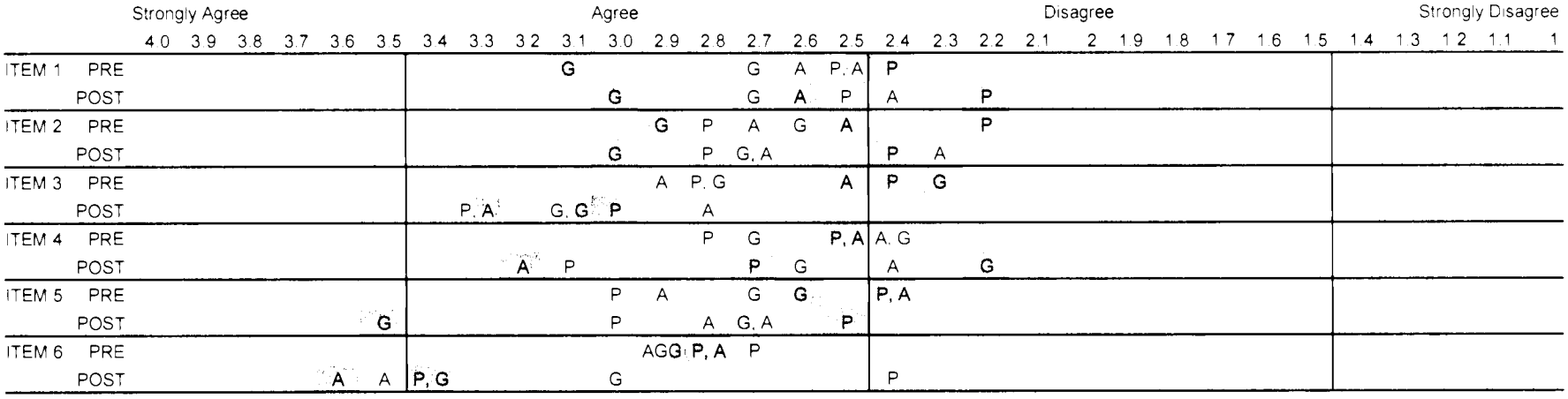
Item	Control			Intervention		
No.	Pre	Post	Gain	Pre	Post	Gain
1	2.7	2.7	0.0	3.1	3.0	-0.1
2	2.6	2.7	0.1	2.9	3.0	0.1
3	2.8	3.1	0.4	2.3	3.1	0.8
4	2.7	2.6	-0.1	2.4	2.2	-0.3
5	2.7	2.7	-0.1	2.6	3.5	0.9
6	2.9	3.0	0.0	2.9	3.4	0.5

Totals

Item	Control			Intervention		
No.	Pre	Post	Gain	Pre	Post	Gain
1	2.6	2.5	-0.1	2.7	2.6	-0.1
2	2.7	2.6	-0.1	2.5	2.7	0.2
3	2.8	3.1	0.3	2.4	3.1	0.7
4	2.6	2.7	0.0	2.5	2.6	0.1
5	2.9	2.8	-0.1	2.5	3.0	0.5
6	2.9	2.9	0.0	2.9	3.5	0.6

STUDENT SURVEY RESULTS

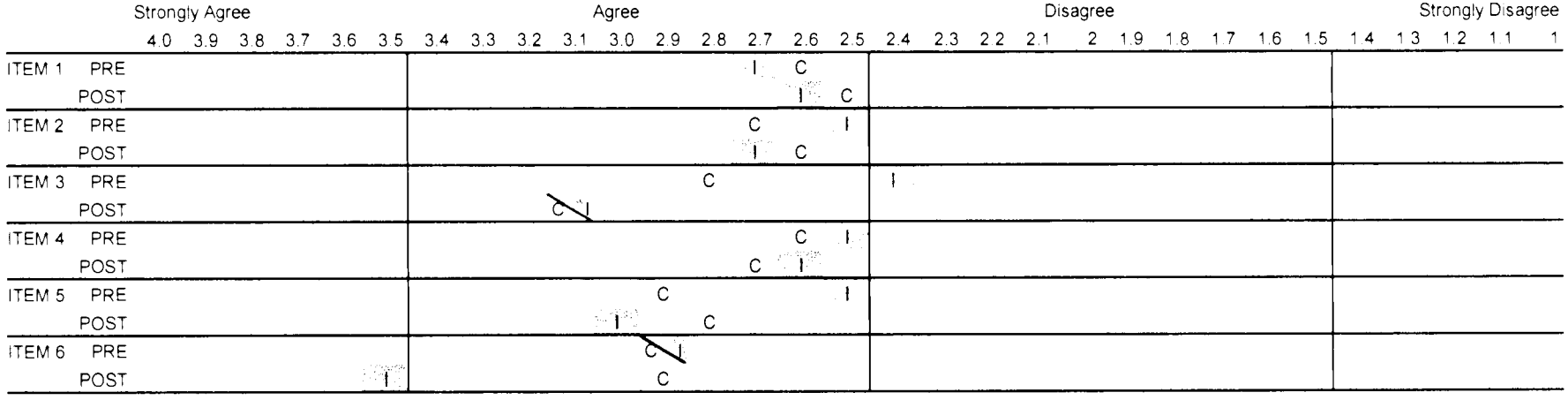
AVERAGE CLASS RESPONSE PER ITEM BASED ON WEIGHTED VALUES



KEY: P - PREALGEBRA A - ALGEBRA 1 G - GEOMETRY Control Groups **Intervention Groups**

STUDENT SURVEY RESULTS

AVERAGE TOTAL RESPONSE PER ITEM BASED ON WEIGHTED VALUES



KEY: C - AVERAGE RESPONSE FOR TOTAL CONTROL GROUP

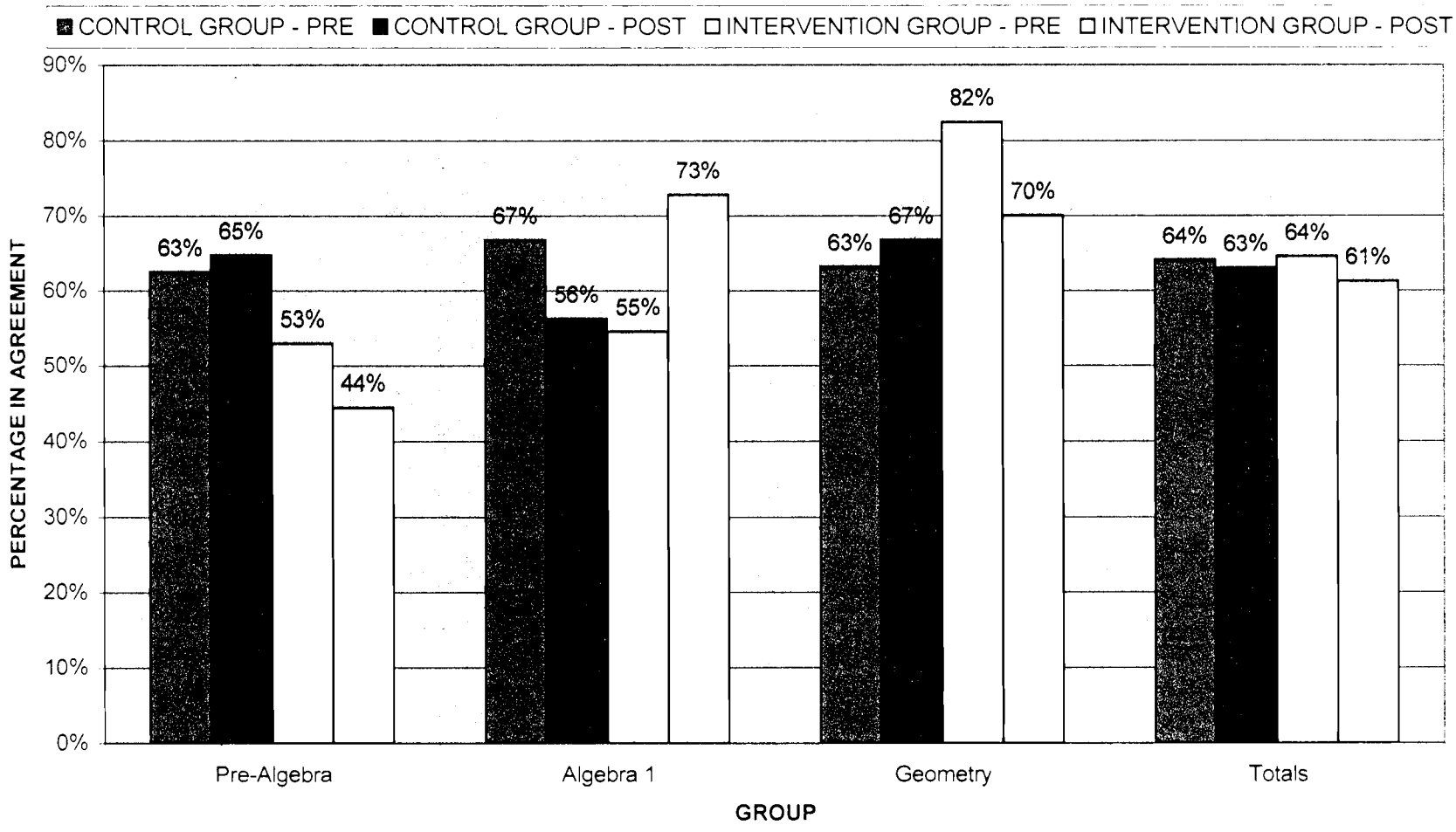
I - AVERAGE RESPONSE FOR TOTAL INTERVENTION GROUP

Percentage of students in agreement with survey statements

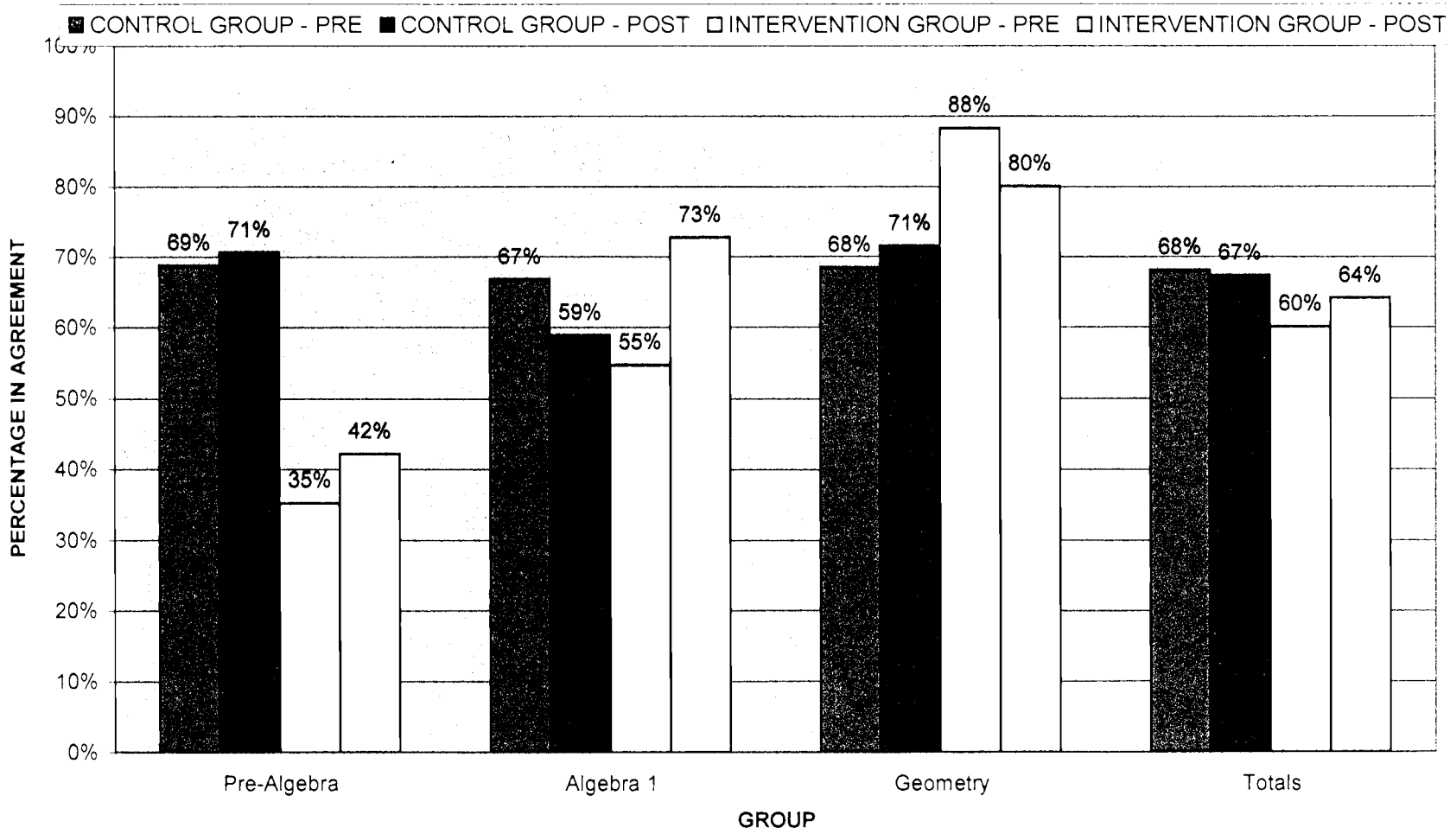
	Pre-Algebra						Algebra 1					
Item	Control			Intervention			Control			Intervention		
No.	pre	post	Gain	pre	post	Gain	pre	post	Gain	pre	post	Gain
1	63%	65%	2%	53%	44%	-8%	67%	56%	-10%	55%	73%	18%
2	69%	71%	2%	35%	42%	7%	67%	59%	-8%	55%	73%	18%
3	69%	81%	13%	41%	82%	41%	80%	75%	-5%	45%	82%	36%
4	63%	75%	13%	53%	56%	3%	47%	44%	-3%	55%	64%	9%
5	75%	82%	7%	47%	50%	3%	87%	60%	-27%	45%	64%	18%
6	56%	53%	-3%	65%	83%	19%	67%	93%	27%	64%	91%	27%

	Geometry						Totals					
Item	Control			Intervention			Control			Intervention		
No.	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain
1	63%	67%	4%	82%	70%	-12%	64%	63%	-1%	64%	61%	-3%
2	68%	71%	3%	88%	80%	-8%	68%	67%	-1%	60%	64%	4%
3	68%	90%	22%	41%	90%	49%	72%	83%	11%	42%	85%	43%
4	53%	62%	9%	41%	30%	-11%	54%	60%	6%	49%	47%	-2%
5	72%	67%	-6%	71%	90%	19%	78%	70%	-8%	56%	69%	14%
6	61%	76%	15%	71%	82%	11%	62%	74%	12%	67%	84%	18%

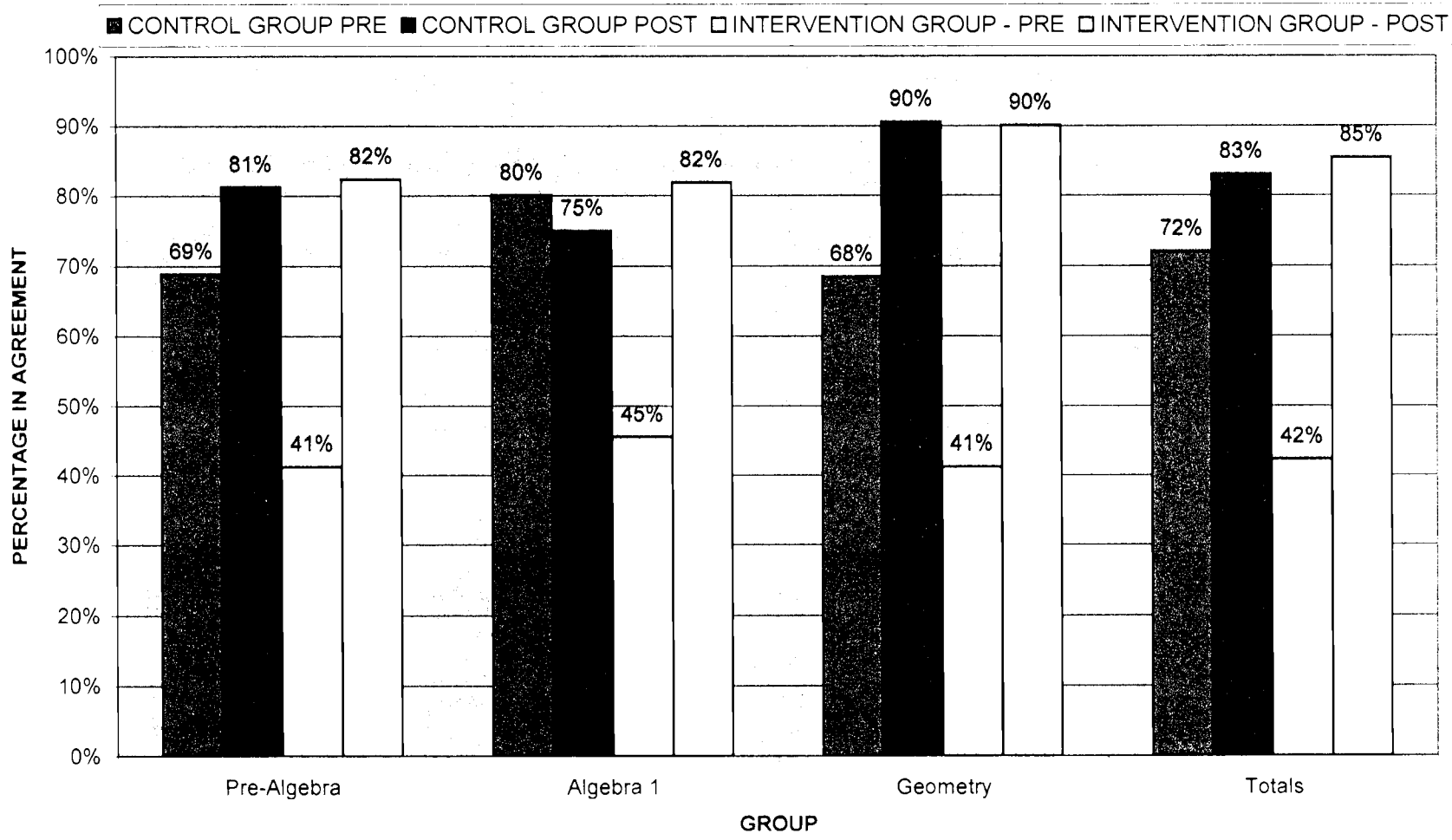
STUDENTS IN AGREEMENT WITH SURVEY ITEM NUMBER 1
"I Like Math"



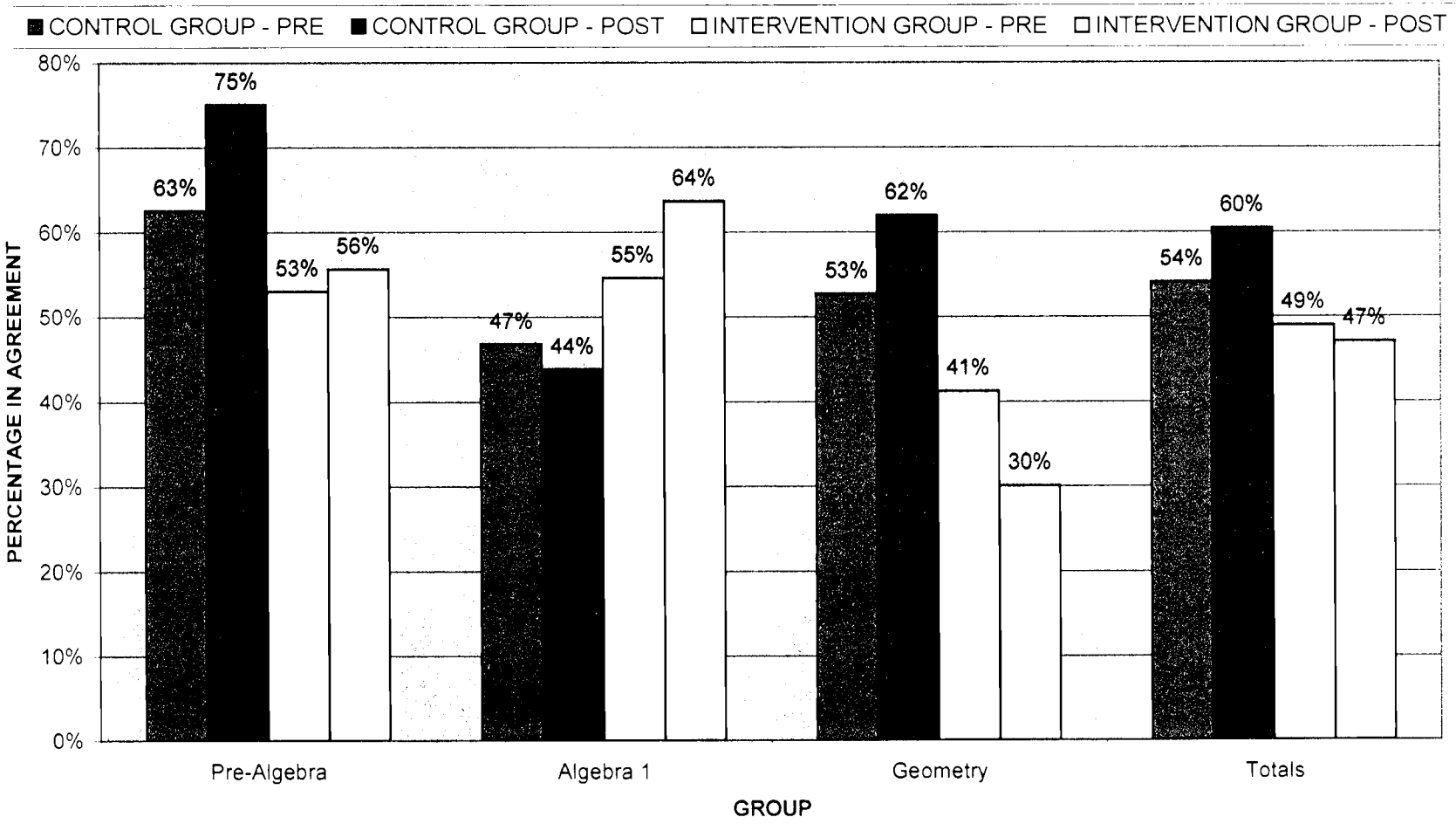
STUDENTS IN AGREEMENT WITH SURVEY ITEM NUMBER 2
"I Think I Am Good at Math"



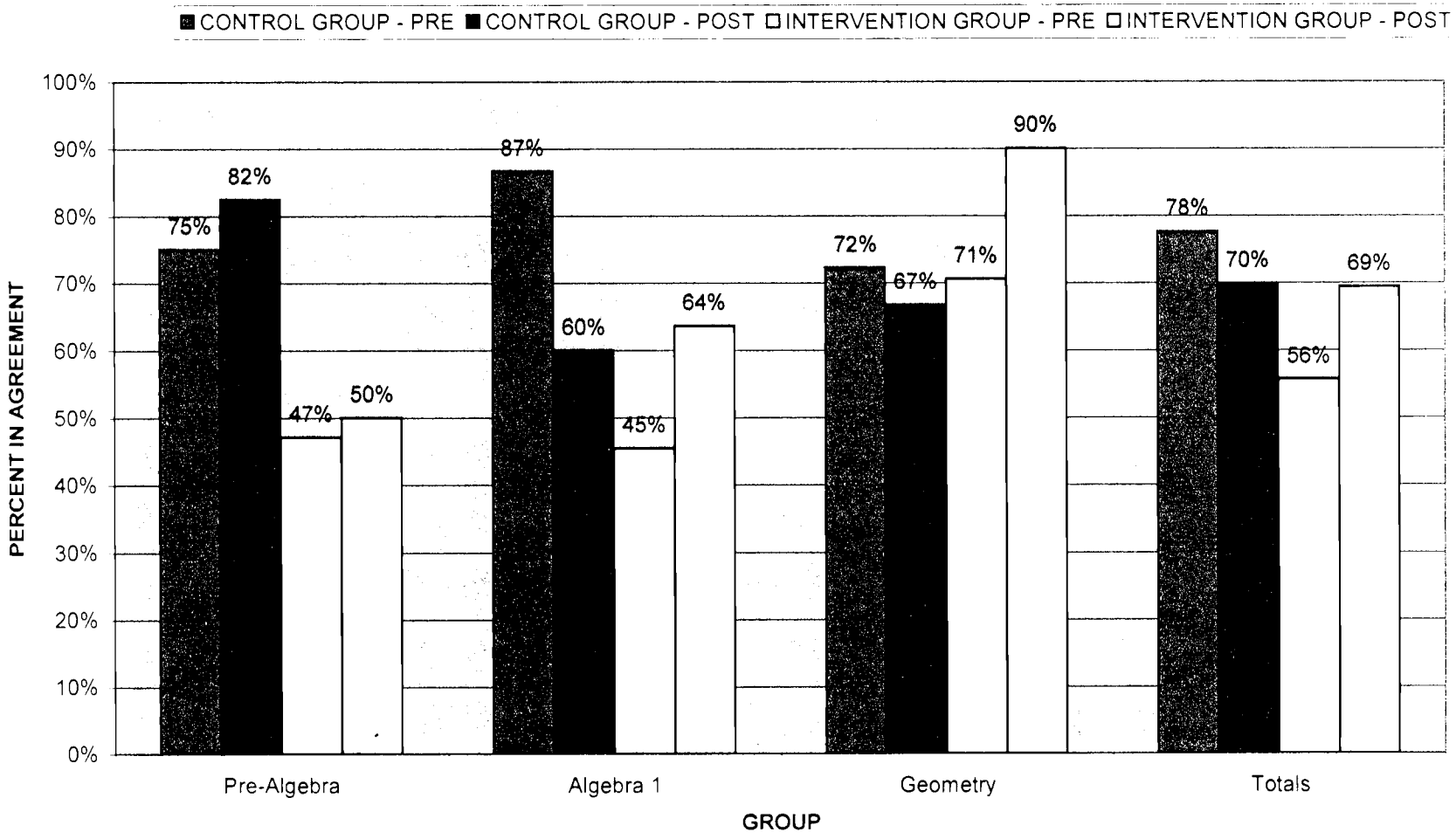
STUDENTS IN AGREEMENT WITH SURVEY ITEM NUMBER 3
"I Learned More Math This Year Than I Did Last Year"



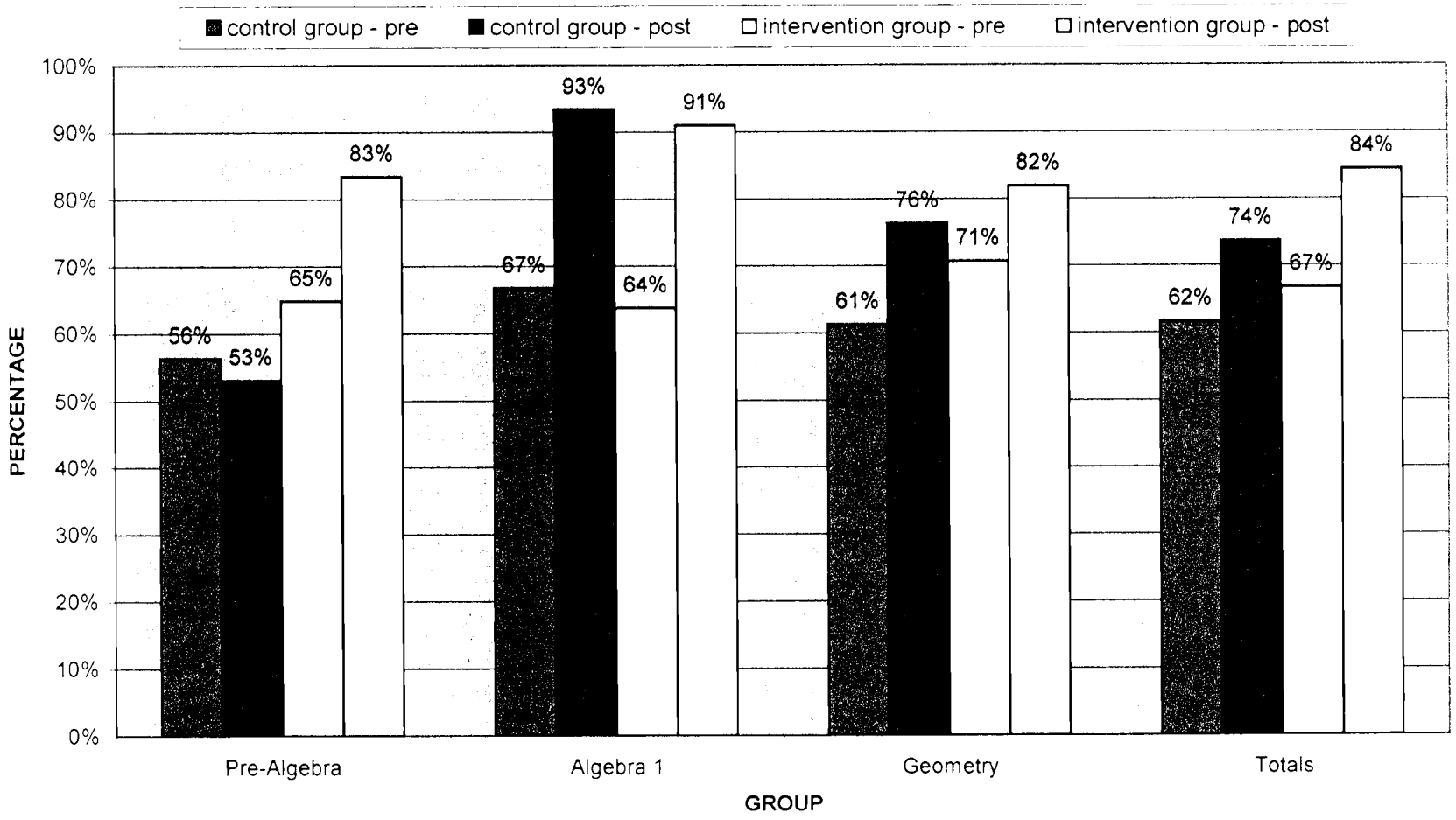
STUDENTS IN AGREEMENT WITH SURVEY ITEM NUMBER 4
"I Spent More Time on Math This Year Than I Did Last Year"



STUDENTS IN AGREEMENT WITH SURVEY ITEM NUMBER 5
"The Pace of this Math Class is Just Right"



STUDENT RESPONSES TO SURVEY ITEM NUMBER 6
Students Who Spend 2 Hours or Less on Homework Each Week



Additional Student Survey Responses for Questions 7 – 10

Mean responses based on weighted values

Item No.	Pre-Algebra Intervention	Algebra 1 Intervention	Geometry Intervention	Totals Intervention
7	2.6	3.1	3.2	2.9
8	3.6	3.5	3.7	3.6
9	3.1	3.2	3.2	3.1
10	3.0	3.5	3.3	3.2

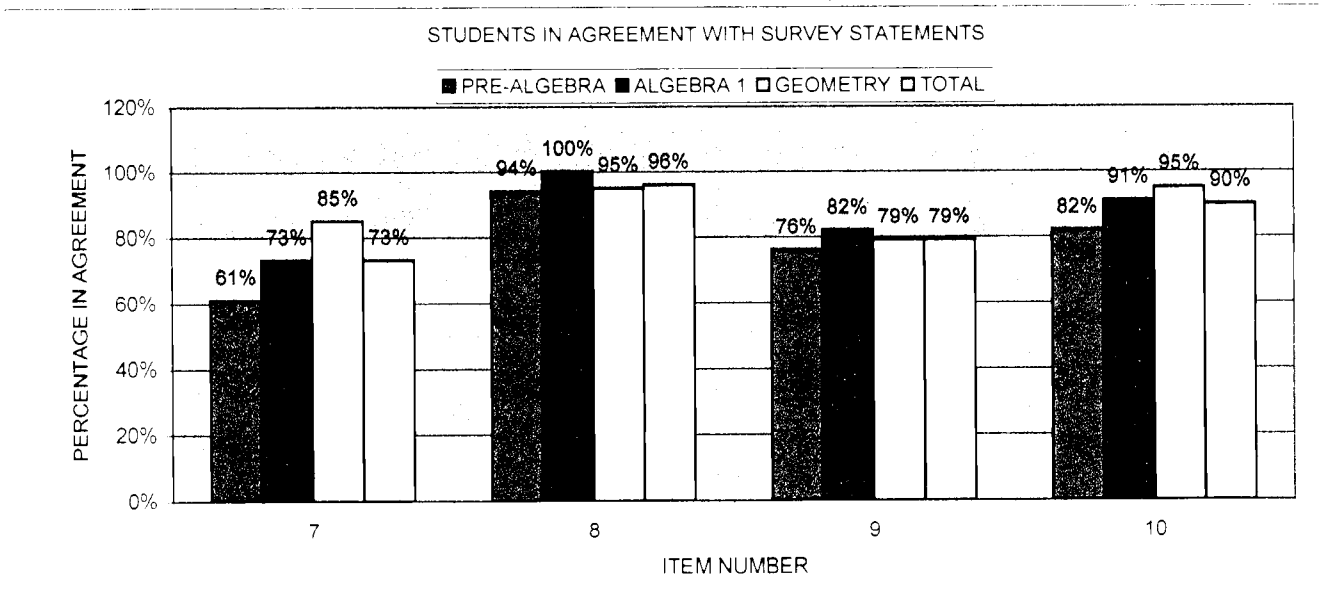
Percentage of students in agreement with survey statements

Item No.	Pre-Algebra Intervention	Algebra 1 Intervention	Geometry Intervention	Totals Intervention
7	61%	73%	85%	73%
8	94%	100%	95%	96%
9	76%	82%	79%	79%
10	82%	91%	95%	90%

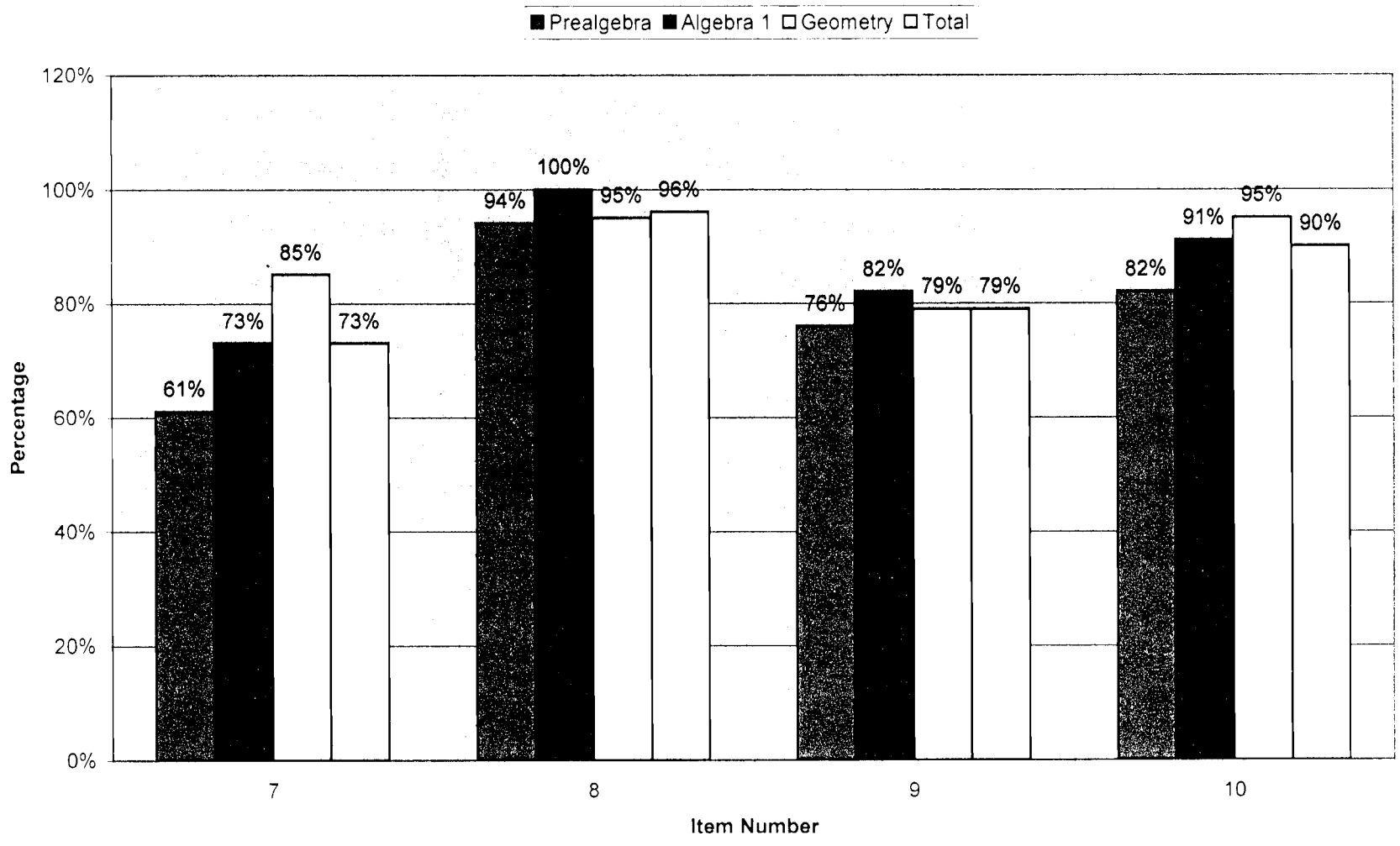
STUDENT SURVEY RESULTS FOR SPECIFIC ACCELERATED MATH ITEMS
ONLY INTERVENTION GROUPS SURVEYED
AVERAGE CLASS RESPONSE PER ITEM BASED ON WEIGHTED VALUES

	Strongly Agree						Agree									Disagree									Strongly Disagree				
	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1
ITEM 7																															
POST									G	A					P																
ITEM 8																															
POST				G	P	A																									
ITEM 9																															
POST									AG	P																					
ITEM 10																															
POST						A		G			P																				

KEY: P - PREALGEBRA INTERVENTION GROUP - MEAN STUDENT RESPONSE
A - ALGEBRA 1 INTERVENTION GROUP - MEAN STUDENT RESPONSE
G - GEOMETRY INTERVENTION GROUP - MEAN STUDENT RESPONSE
TOTAL MEAN RESPONSE FOR ALL INTERVENTION GROUPS



Responses in Agreement to Student Survey Items 7-10



Student Comments Regarding the use of Accelerated Math

Pre-Algebra

Favorable comments from students (things I liked)

- It's easier and faster, you learn as you go
- We were able to work at our own pace. When we learned something we didn't sit there and waste time going over and over it again, we just took a test and got it out of the way.
- It was easier because we could work at our own pace.
- Easier to learn than from a book
- Lets everyone go at their own pace and not everyone else's, and the teacher doesn't have to talk the whole hour.
- It's easier
- If you don't understand something you don't test on it till you are ready. If you know something you don't have to wait.
- It was easier to do problems
- It let me move ahead faster and I got more accomplished with the program. Also, I can now use bubble scan cards more easily (before I could never pass test when I had to use bubble sheets) so this program really helps.
- It is easy and I can work at my own pace
- You didn't have to mess with a book
- It was easy and you get more done in a day
- It makes things go at your own pace
- Didn't have to use books

Unfavorable comments from students (things I did not like)

- I hate the computer
- I like it but then I don't because it's not working at your own pace its mastering objectives in a certain amount of time or you don't pass. I think we should do the objectives on our own pace so we can actually learn it.

Student Comments Regarding the use of Accelerated Math

Algebra 1

Favorable comments from students (things I liked)

- I liked it because it helps with my thinking.
- I liked the multiple choice
- You can copy out of the book and not learn anything, but on the computer you are forced to do it.
- I got a more one on one approach to learning math which is greatly improved math skills. Because of this new system of math I raised my grade from a D to a high B!!
- It helps me to learn at my own pace rather than staying with everyone else.
- I liked it a lot because I felt like I was learning math faster than I would in the book, but, in the end, we were at the same point as everyone.
- You can work at your own pace.
- Yes, because it is multiple choice.
- It's easy and no homework.
- I like working at my own pace. If I didn't understand something I could spend more time on it and not get behind. I REALLY hope we have this program next year. I went from an F to an A.
- Because you can set your own pace. Not everyone likes staying with the class. So then you can go as fast as you want.

Unfavorable comments from students (things I did not like)

(none)

Student Comments Regarding the use of Accelerated Math

Geometry

Favorable comments from students (things I liked)

- I like it because you can go your own pace...
- I liked being able to instantly find out how I did on my work.
- I liked it because it forced me to do the practice stuff before I didn't do homework before, and I learned more with the computer.
- Because you could go at your own pace and you didn't have to wait. I learned the stuff a lot better because you know it better when you help the other people in the class.
- I liked it b/c I was able to work at my own pase, weather it was faster or slower than the other students in my class. I also think that I learned more since I was able to work at my own pase.
- I liked it because it gave you practice and it reviewed old stuff. It also allows a person to go as fast or as slow as they want or need.
- It's easier my grade aproved
- I like it a lot. I think if I would have come in early more I probably would have done better!
- I liked the fact I could work on my own terms. I also learned more because I went one on one more with the teacher.
- Because I could go at my own pace.
- It takes more problem solving skills and more time to figure out the problems.
- I could learn better at my own pace and not rushing through things.
- It was pretty nice using the computer and working at my own pace.
- I liked that I could help people, and by teaching it to others, I learned the math better.
- I liked it better with the computer b/c I worked at my pace and learned it by myself and had one on one help.
- I liked it because you could go at your own pace. Fast people didn't have to wait, and slow people weren't holding others back.
- Because I worked at my own pace.

Unfavorable comments from students (things I did not like)

- ...but I don't like it when teacher don't explain things as well.
- Nope
- The only thing I liked was no homework.
- The only problem was that we had a certain point to be at, and it demolished the whole point of working at your own pace.

Additional Parent Survey Responses for Questions 1-6

Mean responses based on weighted values

Pre-Algebra

Item	Control			Intervention		
No.	Pre	Post	Gain	Pre	Post	Gain
1	2.8	3.3	0.5	3.0	3.0	0.0
2	3.1	3.1	0.0	3.2	3.5	0.3
3	2.9	3.2	0.3	2.9	3.4	0.5
4	3.1	2.9	-0.2	2.9	3.1	0.2
5	2.8	2.8	0.0	2.9	2.6	-0.3
6	3.2	2.6	-0.6	3.2	3.3	0.1

Algebra 1

Item	Control			Intervention		
No.	Pre	Post	Gain	Pre	Post	Gain
1	3.8	2.4	-1.4		3.0	
2	4.0	2.0	-2.0		3.0	
3	4.0	2.6	-1.4		3.0	
4	3.5	2.3	-1.2		2.3	
5	3.0	2.2	-0.8		2.0	
6	2.5	2.9	0.4		4.0	

Geometry

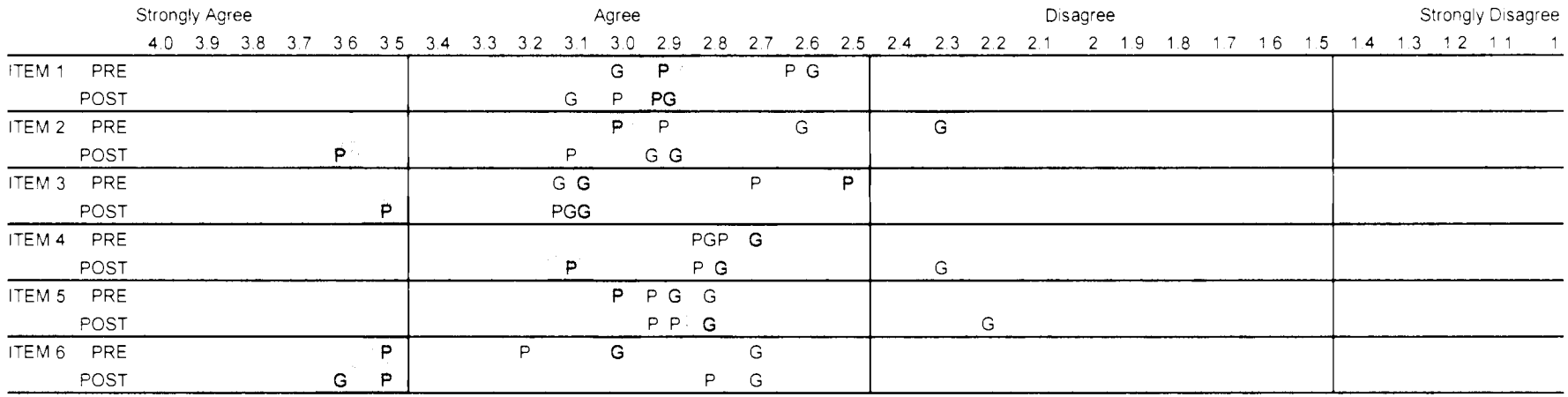
Item	Control			Intervention		
No.	Pre	Post	Gain	Pre	Post	Gain
1	3.2	3.3	0.1	2.6	3.3	0.7
2	2.8	3.1	0.3	2.7	3.1	0.4
3	3.2	3.2	0.0	3.3	3.4	0.1
4	3.2	2.9	-0.3	2.9	3.1	0.2
5	2.7	2.4	-0.3	2.7	2.3	-0.4
6	2.7	2.7	0.0	2.7	3.6	0.9

Totals

Item	Control			Intervention		
No.	Pre	Post	Gain	Pre	Post	Gain
1	3.1	3.1	0.0	2.8	3.2	0.4
2	3.1	2.9	-0.2	2.9	3.2	0.3
3	3.2	3.1	-0.1	3.1	3.4	0.3
4	3.2	2.7	-0.5	2.9	3.0	0.1
5	2.8	2.5	-0.3	2.8	2.4	-0.4
6	2.8	2.7	-0.1	2.9	3.5	0.6

PARENT SURVEY RESULTS

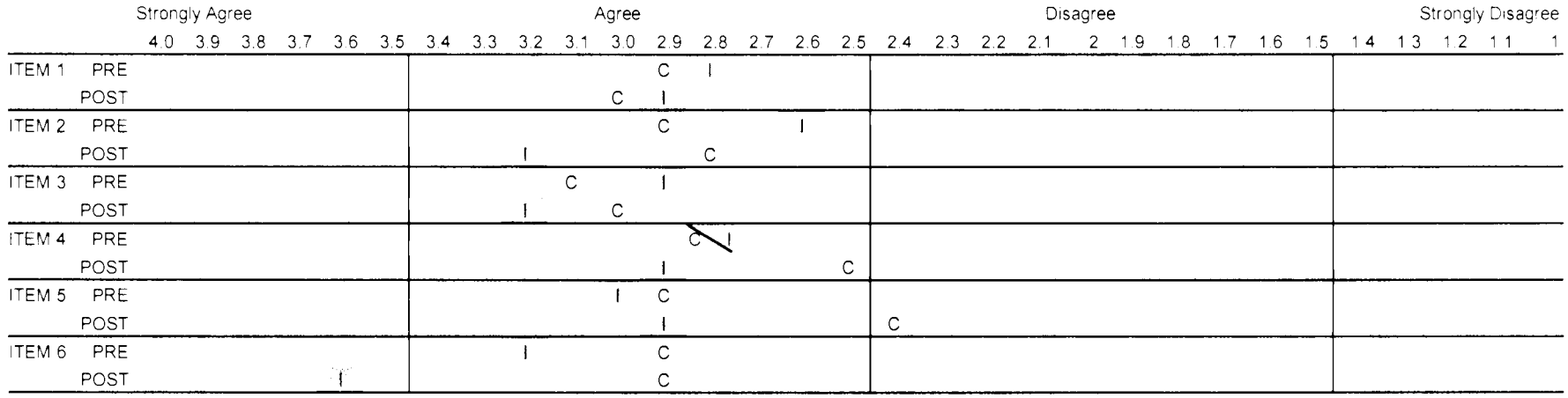
AVERAGE PARENT RESPONSE PER CLASS PER ITEM BASED ON WEIGHTED VALUES



KEY: P - PREALGEBRA A - ALGEBRA 1 G - GEOMETRY Control Groups **Intervention Groups**

PARENT SURVEY RESULTS

AVERAGE TOTAL RESPONSE PER ITEM BASED ON WEIGHTED VALUES



KEY: C - AVERAGE PARENT RESPONSE FOR TOTAL CONTROL GROUP

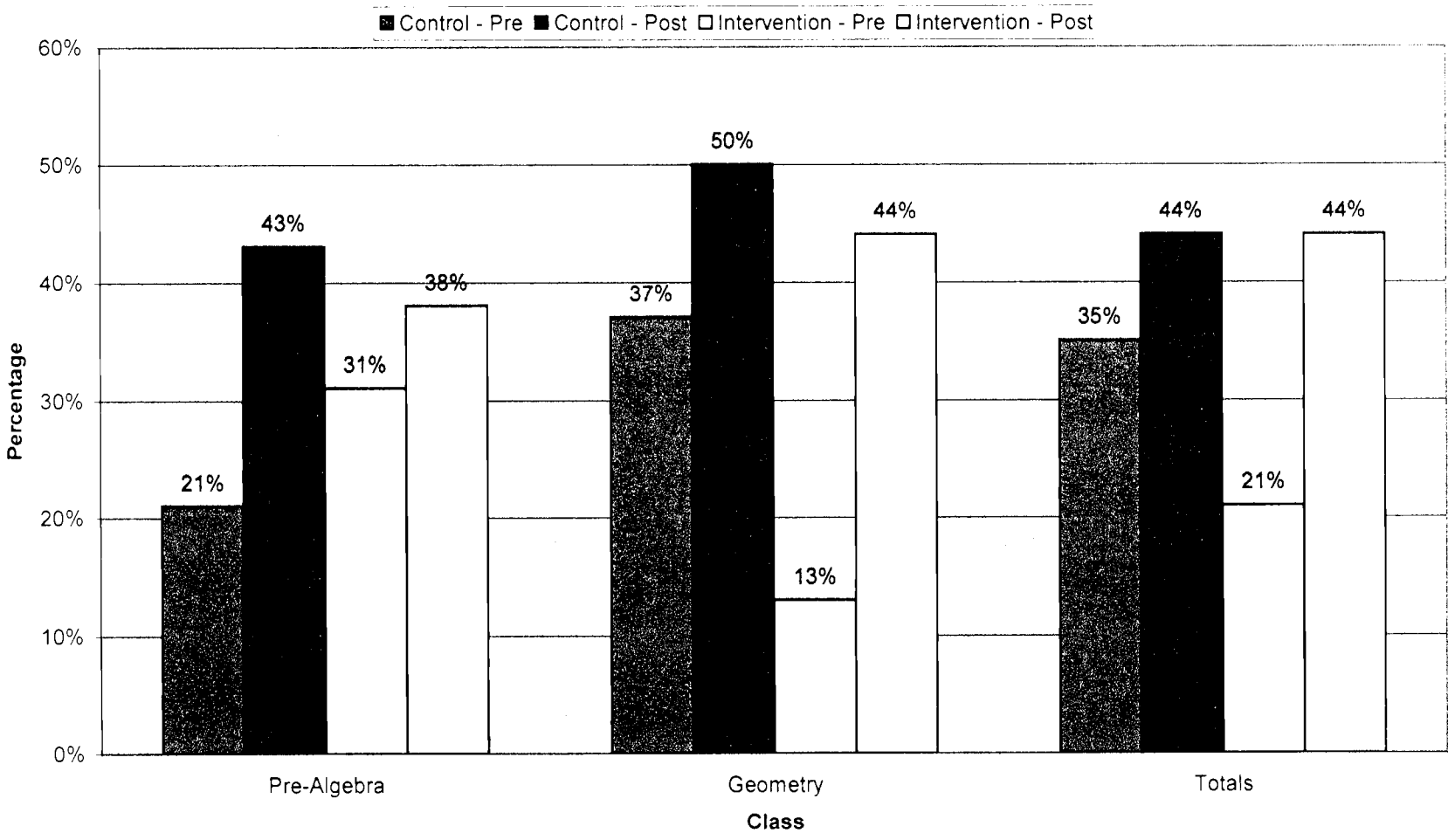
I - AVERAGE PARENT RESPONSE FOR TOTAL INTERVENTION GROUP

Percentage of parents in agreement with survey statements

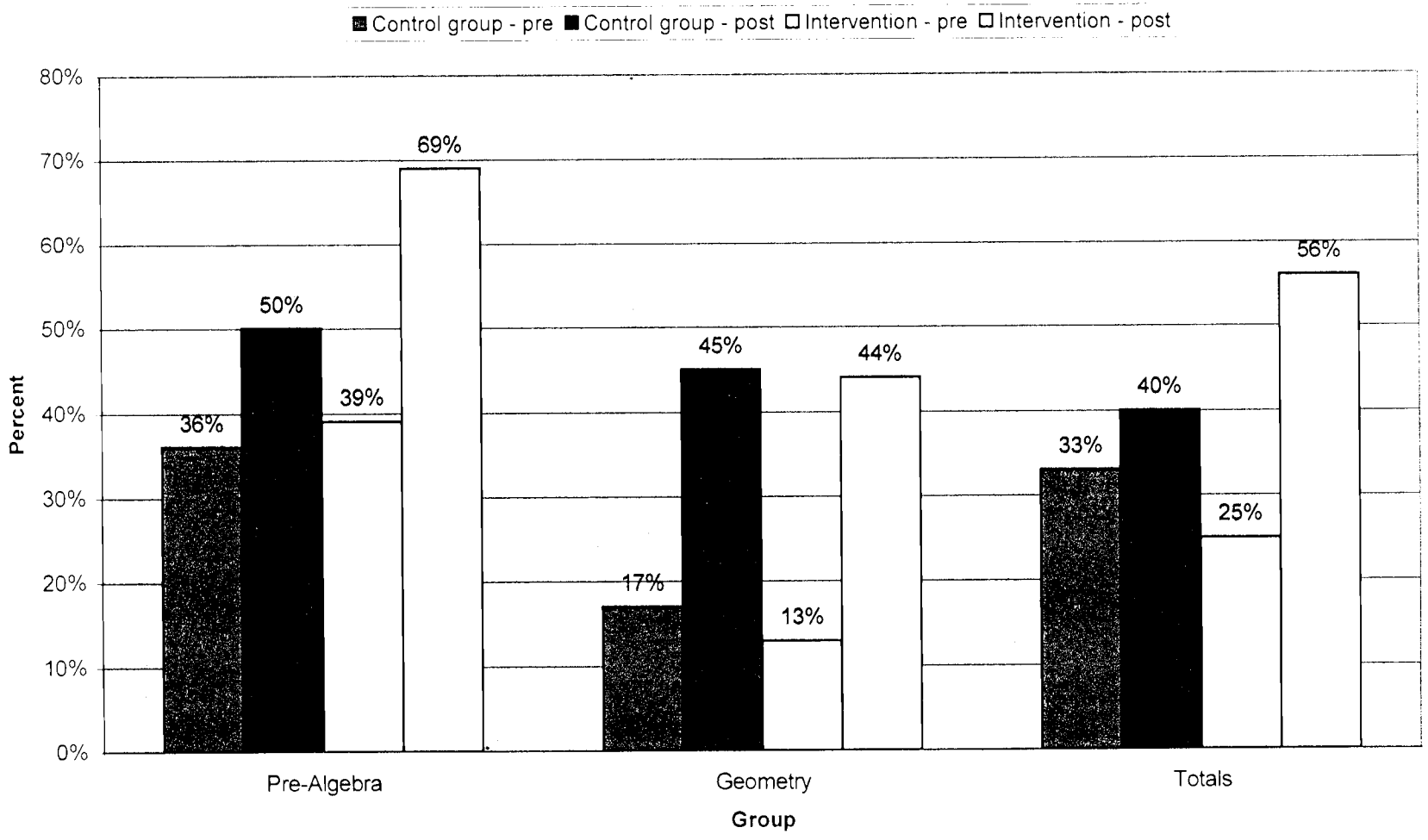
Item	Pre-Algebra						Algebra 1					
	Control			Intervention			Control			Intervention		
No.	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain
1	21%	43%	22%	31%	38%	7%	75%	33%	-42%		67%	
2	36%	50%	14%	39%	69%	30%	100%	11%	-89%		67%	
3	29%	54%	25%	23%	62%	39%	100%	22%	-78%		67%	
4	29%	29%	0%	23%	38%	15%	50%	11%	-39%		33%	
5	21%	21%	0%	31%	15%	-16%	50%	0%	-50%		0%	
6	77%	64%	-13%	92%	92%	0%	50%	100%	50%		100%	

Item	Geometry						Totals					
	Control			Intervention			Control			Intervention		
No.	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain
1	37%	50%	13%	13%	44%	31%	35%	44%	9%	21%	44%	23%
2	17%	45%	28%	13%	44%	31%	33%	40%	7%	25%	56%	31%
3	44%	50%	6%	47%	56%	9%	44%	45%	1%	36%	59%	23%
4	33%	20%	-13%	20%	33%	13%	33%	21%	-12%	21%	35%	14%
5	17%	15%	-2%	20%	11%	-9%	22%	14%	-8%	25%	12%	-13%
6	60%	60%	0%	77%	88%	11%	66%	69%	3%	85%	91%	6%

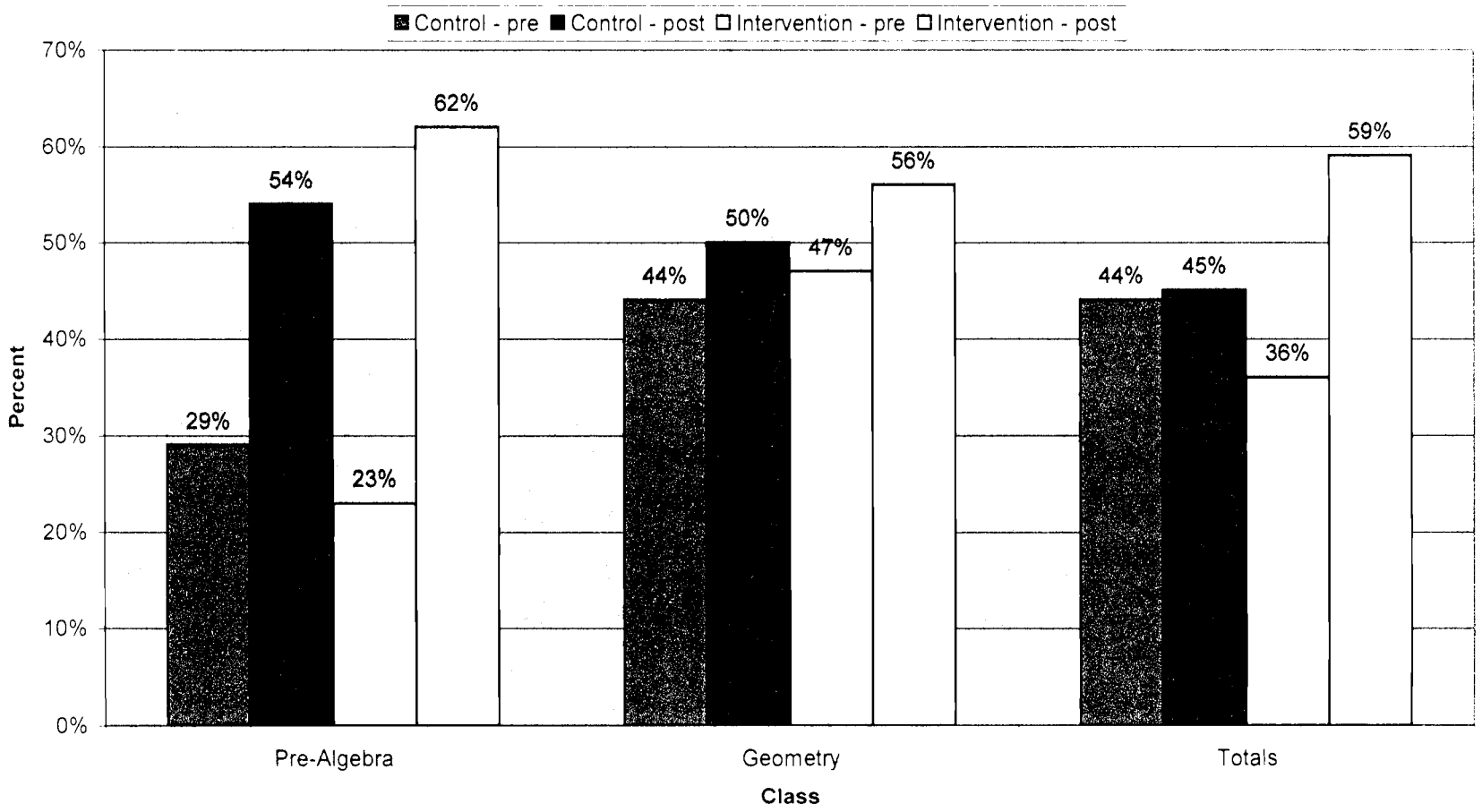
Parents in Agreement with Survey Item Number 1
"My Child Likes Math More This Year Than Last Year"



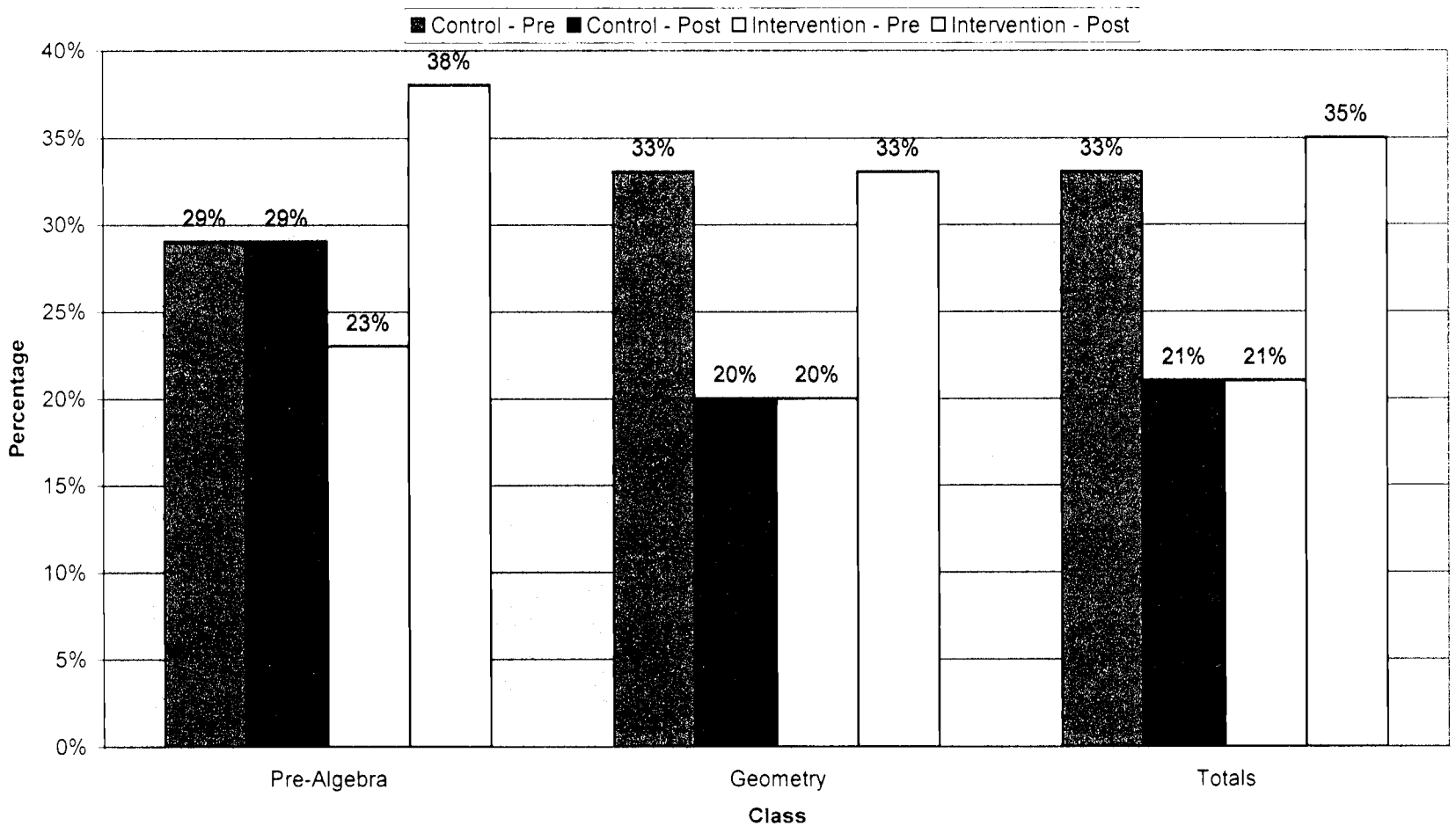
Parents in Agreement with Survey Item 2
"My Child is Learning Math Better This Year Compared to Last Year"



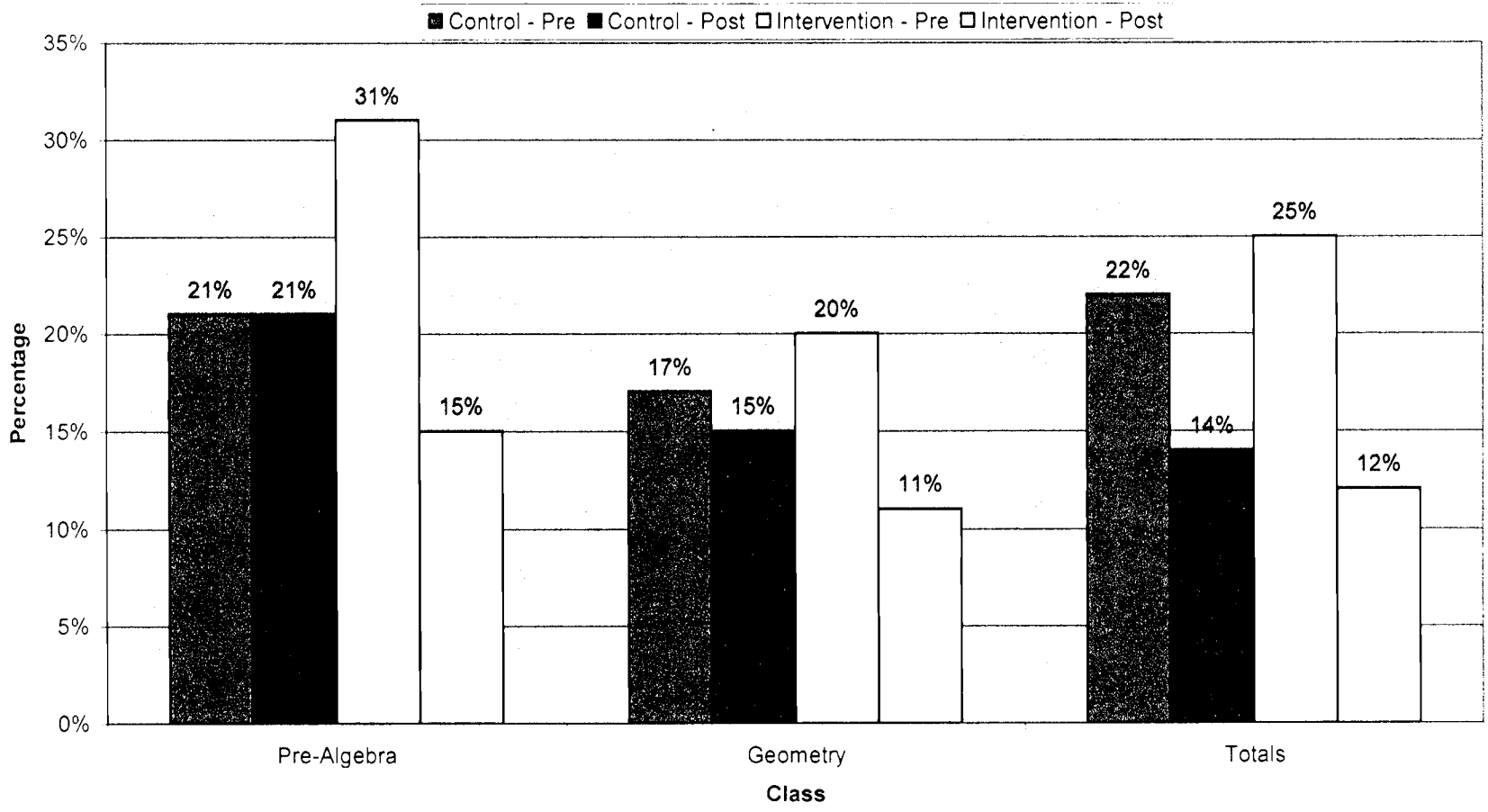
Parents in Agreement with Survey Item Number 3
"My Child is More Confident in Math This Year Compared to Last Year"



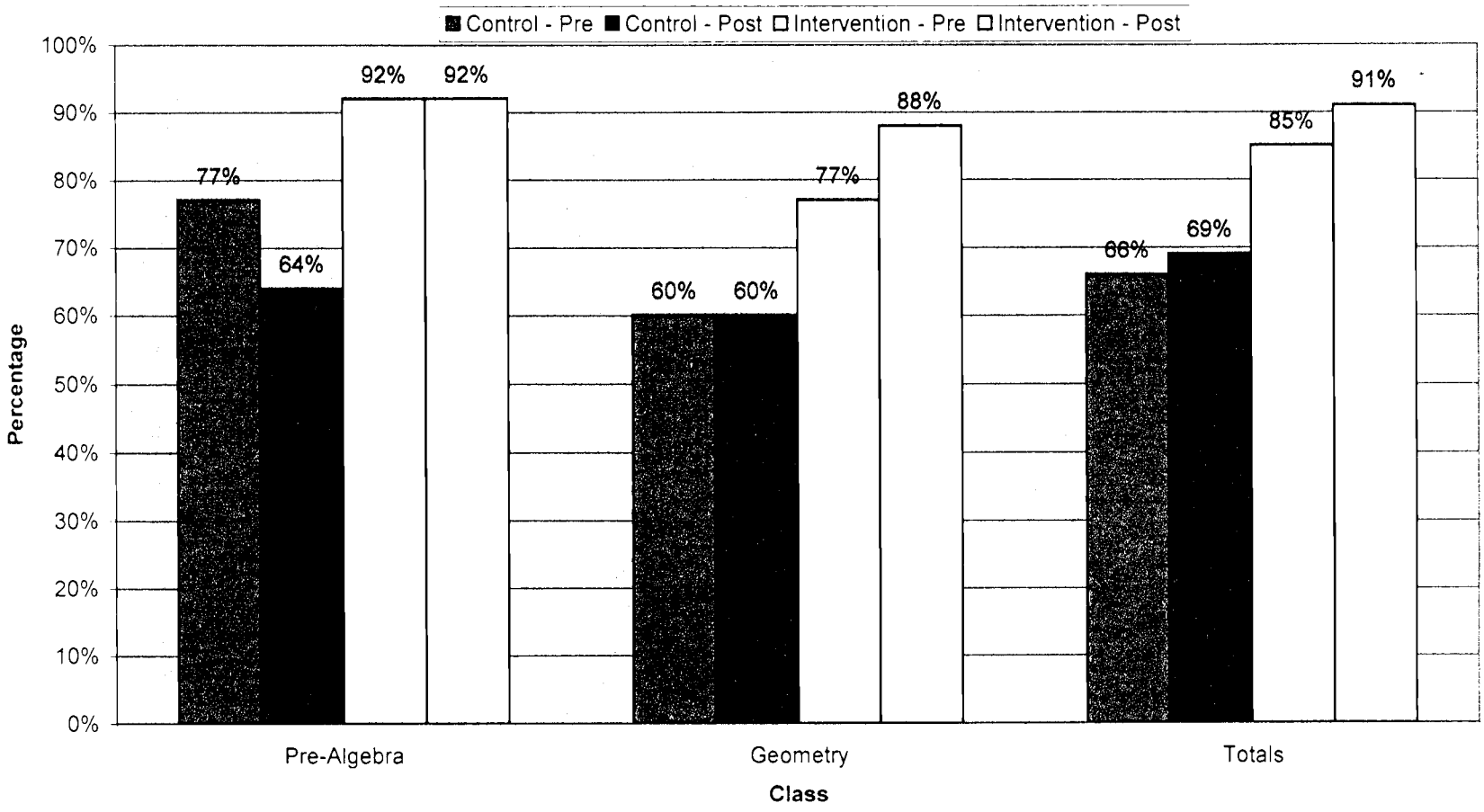
Parents in Agreement with Survey Item Number 4
"My Child is More Motivated to Work on Math This Year"



Parents Responding "Yes" to Survey Item 5
"My Child Spends More Time on Math Homework This Year"



Results for Survey Item Number 6
Parents who observe children doing 0-2 hours of math homework per week



Parent Comments Regarding the use of Accelerated Math

Pre-Algebra

Favorable comments from parents (compliments)

- Thank you for making (Student) work harder...enjoys your class...
- This is a good program; it forces children to learn the facts before moving on. This should help with an easier year to follow.
- Keep up the great work!

Unfavorable comments from parents (concerns)

- We have not liked how there is no book; we could help (Student). Student was under the impression they could work at own pace, but was then told they had to master a specific amount....
- Student seldom ever brings homework to do.

Algebra 1

Favorable comments from parents (compliments)

(none)

Unfavorable comments from parents (concerns)

(none)

Geometry

Favorable comments from parents (compliments)

- Seemed to have a better understanding of the concepts this year. Thanks for everything.
- (Student) has enjoyed this program. She feels confident taking her tests when she covers the whole program for that test...

Unfavorable comments from parents (concerns)

- I think they need to show their work instead of having multiple choice.
- Need more people to help them when they are having a problem. Not enough teacher to go around to all of the students. Causes students to get behind.
- ...unfortunately she does not feel she remembers what she learned and is worried about the final.

Teacher Survey Results for Questions 1 – 16

ITEM	Strongly Agree	Agree	Disagree	Strongly Disagree	Don't Know
1	1	2			
2		2	1		
3	2			1	
4	1	2			
5	2	1			
6		2	1		
7	1	2			
8		2		1	
9	1	1			1
10	1	1	1		
11			2		1
12	1	2			
13	1	2			
14		2			1
15	3				
16		3			
Total	14	24	5	2	3

Teacher Survey Results for Questions 17 – 24

17. Did you change the way you teach math because of using Accelerated Math? Please explain.

Teacher A: Yes – no notebooks required, less lecture time
Teacher B: Yes – I didn't ever lecture but explained each topic individually to the student.
Teacher C: Yes – totally individualized, no group lessons

18. Did you keep your whole class together in their work using Accelerated Math, allow students to work at their own rates through the objectives, or have another system? Please explain.

Teacher A: Students were allowed to work at their own rate, as long as they mastered a minimum number of objectives.
Teacher B: They worked at their own rates but I did have a set goal of objectives mastered they were supposed to get to.
Teacher C: Everyone worked at his/her own rate.

19. Do you think Accelerated Math had a positive effect on girls' achievement in math, their attitude towards math, or their confidence? Please explain.

Teacher A: Yes and No. One student in particular mastered all of the assigned pre-algebra objectives and the majority of the algebra 1 objectives. Another girl did not master as many as she needed to.
Teacher B: I really can't answer this. I only had 3 girls in the class and they were always pretty confident.
Teacher C: I can not really comment on this – the girls did just as well as the boys and vice versa.

20. How would you describe student interactions in your math class? For example, were students helping each other informally? Were they working in assigned groups? Please explain.

Teacher A: Several students worked informally to help each other as needed. I also used assigned cooperative learning groups at different times.
Teacher B: They did not have much interaction at all. Most do not get along and would prefer to work on their own to get stuff done faster.
Teacher C: The students asked each other for help when they needed it. There were no assigned groups.

21. Teachers using Accelerated Math have reported that students learn math through various combinations of whole-class lessons, one-on-one explanations, small group instruction, students learning on their own, students working cooperatively, or other means. How do students learn math in your class?

Teacher A: I used a mixture of the above.
Teacher B: Mainly one-on-one.
Teacher C: By working at his/her own pace and using other students, the teacher and the textbook as a resource.

22. If your students spend more time doing math this year, is this due to an increase in the math period time, more efficient use of class time, or some other factor? Please explain.

Teacher A: Students made more efficient use of class time as they always had something to work on. Most did not work much outside of class.
Teacher B: They spend less time doing any work outside of class...in fact I don't believe anyone took math work home.
Teacher C: More efficient use of class time.

23. Does Accelerated Math help prepare your students for high-stakes testing? Please explain. (This question may not apply to you.)

Teacher A: Yes, students are familiar with the format, and have learned to use the process of elimination and work backward to find the answer.
Teacher B: ?? Perhaps it helps them in taking a multiple-choice test.
Teacher C: Yes – get better at doing multiple-choice test.

24. Please list the Accelerated Math reports that you find most valuable and briefly explain how you use them.

Teacher A: Status of the class- to see which students have which practices, exercises, etc. and how long they have been working on them. Also the diagnostic report to check accuracy of work – both for a certain time period and for daily work.
Teacher B: Diagnostic was used mostly... I used it to figure their grades by using the Practice, Review, Test Percentages AND the objectives mastered.
Teacher C: Diagnostic is really the only report I looked at.

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